REFINER
AND NATURAL GASOLINE MANUFACTURER

SEPTEMBER, 1931
Vol. 10, No. 9

A Gulf Publishing Company Publication
EDITED MONTHLY AT TULSA, OKLAHOMA

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GRADY TRIPLETT
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SPECIALIZED OIL JOURNALS
Published by
GULF PUBLISHING COMPANY

OFFICE OF PUBLICATION
3301 Buffalo Drive, Houston, Texas

R. L. DUDLEY, *President*
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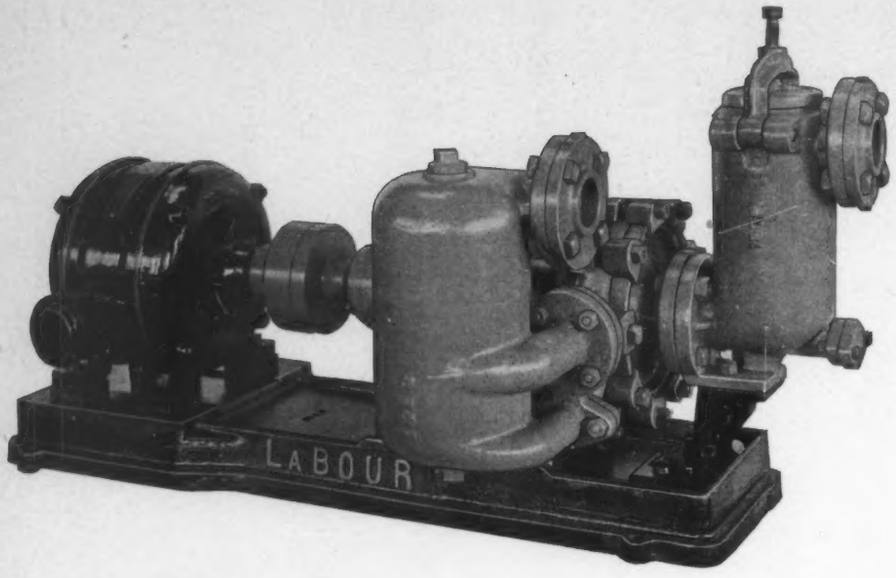
TULSA, 913-916 Hunt Building, J. F. Carter, Jr., Manager.

FORT WORTH, 203 W. T. Waggoner Building H. H. King, Manager.

Single copies 20 cents. Domestic and Foreign subscription price, $1.00 a year. Entered as second class matter June 16, 1923, at the post office at Houston, Texas, under Act of March 3, 1879. Advertising rates on application.



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A GULF PUBLISHING COMPANY PUBLICATION

VOLUME 10, NO. 9 SEPTEMBER, 1931

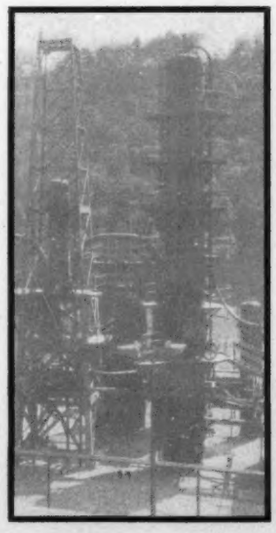
EDITORIALS

Cork the Red Ink Bottle!

WITH the aid of orders of martial law, stocks of gasoline are being brought into proper line. What refiners evidently would not do for themselves came about through the working of political moves in an economic emergency. The Governors of Oklahoma and Texas adopted military rule to halt the excessive production of crude oil.

One result of these moves has been the depletion of stored gasoline. Whether the reduction finally amounts to as much as the statisticians had fixed as a desirable total is a question of little merit. The issue before the refining industry today is whether it will hold the advantage given it by a cause which was not anticipated and over which the refining industry had no control.

Some time early in September the military restrictions should be removed in Texas and Oklahoma. Allowable output will make it possible for refiners to increase throughput. Unless plans of state officials miscarry there will be higher prices for crude. Already the price of refinery gasoline has responded to military rule and doubled in price.



Thus the stage has been set for a period of profit-making in the petroleum industry. But it is only a setting. There is no assurance that the acting will be in keeping with the setting; for it is a stage set for a period of making too much gasoline.

A fair price and plenty of crude oil have been a combination of great temptation to refiners over a long period. The danger of today is for a repetition of this old run of affairs. East Texas will contribute its share of crude oil; so will Oklahoma City and Seminole. Crude oil will be ample if not plentiful. Gasoline prices will be attractive when compared with what quotations have been over the first half of 1931. In such a situation there is danger; for it will be such an easy thing to set refinery output at a pitch which will end the motoring season with stocks mounting again.

Mounting stocks through the winter will spell lower prices for the coming of the next motoring season. Only the determination of those who set the pace of refining speed, stands between the petroleum industry and a period of profit. Instead of increased stocks the proper course for the winter should be one of diminishing stocks. Consultation of the course of storage figures over recent years gives little hope of a declining curve for the winter.

But it would seem that the reasoning of those who set refinery speed would result in sufficient check that the line which pictures gasoline stocks would hold at even keel through the winter. Even with that the petroleum industry can enter 1932 with a chance to cork the red ink bottle.

East Texas Natural Gasoline

SEVERAL companies are planning construction of absorption type natural gasoline extraction plants in the East Texas field where natural gas production yields an average of three to five gallons of gasoline per thousand cubic feet. The relatively rich gas yields gasoline requiring but little treatment after extraction to meet standard specifications.

The recent order of the Texas Railroad Commission which permits oil production at the rate of 225 barrels per well, does not restrict natural gas production materially, inasmuch as the order states that no well shall produce with a gas oil ratio higher than 700 cubic feet of gas per barrel of oil. Evidence offered that the hearing at Austin, recently, indicates that the average gas-oil ratio has been around 350 cubic feet of gas per barrel of oil. If this average is maintained the field may be expected to yield around 140,000,000 cubic feet of gas per day from 1760 wells producing at this time. On the basis of five gallon gas there is available from this field a total of 700,000 gallons of gasoline daily, worth at five cents per gallon, $35,000.00.

The relatively low yields of gas per well, and the knowledge of field conditions experienced in other Woodbine sand fields where natural gas production has always been short lived, have contributed much to the hesitancy of gasoline manufacturers in erecting natural gasoline extraction plants in this territory. Also, the price of natural gasoline during the early period of exploitation in the East Texas territory has not invited plant construction. These factors have tended to offset the advantage of rich gas production and have retarded the establishment of gasoline plants.

Recent developments, however, point to the early erection of such equipment in the field. With gasoline prices increased from less than three cents to above five cents the possibilities of East Texas gas production have been brought to the attention of gasoline manufacturers and gas testers and inspectors for a number of companies have been busy sizing up conditions in the field.

With total gas production of only two or three hundred million cubic feet per day, two or three large natural gasoline plants could easily handle all of the production, were it not for the great area of the field. In East Texas it is necessary that a large number of smaller units be erected to handle the rich gas. The majority of these plants will be of the two or three-absorber type, handling ten to twenty million cubic feet of gas per day. Some of the gasoline plants will be of compression type inasmuch as the rich gas lends itself well to this method of processing.

Seven companies are now planning early construction of such plants in this area including two compression plants and the remainder of absorption type. In some instances jointly owned plants will be erected by owners of adjoining properties.

Refinery Stabilization Improves Market Outlook

REFINERY runs to stills have apparently become stabilized at about 2,500,000 barrels daily, despite the fact that the demand for gasoline continues to effect a sharp reduction in stocks. Report of the American Petroleum Institute for the week ending August 29 shows that gasoline stocks declined again, to a total of 33,250,000 barrels. This compares with stocks of 34,068,000 barrels at the end of the preceding week. While gasoline stocks have shown a steady decline since the week ending May 9, a decline that amounted during that period to a total of 12,560,000 barrels, runs to stills have been maintained at an average of about 2,500,000 barrels. This indicates that the refining industry has made marked progress in exercising control over its operations and shows that every effort is being made to prevent the manufacture of surplus supplies of gasoline.

That stabilization of refinery still runs at around 2,500,000 barrels daily is rapidly correcting the refined oil statistical position is evidenced by the marked reduction in stocks as pointed out above. In

fact, gasoline stocks have already been reduced from the peak of this year to the extent of 14,194,000 barrels. Under such conditions it is not surprising to find that the gasoline market structure is showing strength. By maintaining refinery operations at their present level, the industry has materially corrected the former top-heavy gasoline situation and has effected a decidedly hopeful outlook for the balance of this year. Unless all signs fail, the refined oil market outlook is considerably brighter than it was even a month ago and the events now taking place marketwise are undoubtedly laying the ground-work for a vastly improved economic situation for next year.

Seventy-Two Years of Over-Production

SEVENTY-TWO years ago, on a sultry Saturday afternoon, August 27, 1859, "Uncle Billy" Smith and his son, Sam, experienced well drillers working under Colonel Drake, superintendent of the Titusville, Pennsylvania, properties of Pennsylvania Rock Oil Company and Seneca Oil Company, drew their iron bit from the 69½-foot hole in the Titusville creek bed and found a black, oily liquid bubbling near the top of the hole. With an old pitcher pump these pioneer oil drillers drew several barrels of the liquid from the hole, then mounted a mule and hurried to the general store in Titusville to tell a laughing, unbelieving crowd that "Drake's Folly" was no longer a dream. Thus was born the petroleum industry and a new era of light.

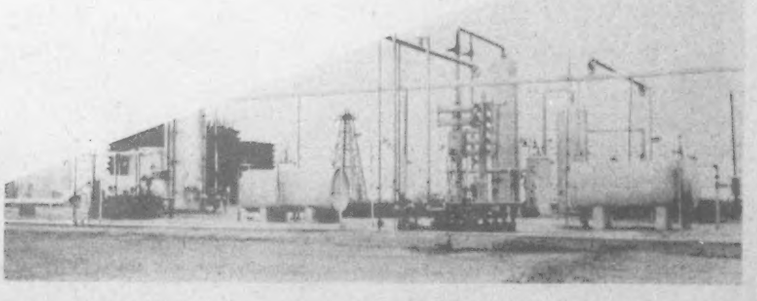
There followed a typical oil boom; and the price of petroleum declined rapidly from $21 to a few cents a barrel. The law of supply and demand had been overstepped.

Thus the sudden demand for crude oil, considered a nuisance by those earlier seekers of brine—resulted in the founding of an industry. Later, in 1910, the sudden demand for a nuisance by-product of crude, gasoline, led to unprecedented expansion and development which received a forward impetus during the World War. Fear of exhaustion of this irreplaceable natural resource thereupon resulted in a feverish search for new sources of supply with resultant over-production.

Today, 72 years after the discovery of oil, the petroleum industry is in much the same predicament it found itself back in the '60s when over-production in Pennsylvania brought the price down to a few cents a barrel. Later, at the beginning of the twentieth century, came Spindletop and its flood of cheap oil; then came the development of other flush fields as the Glenn pool, Cushing, West Texas, Mexia, the Los Angeles basin fields, Powell and others, with the ever present fear of ruin of the industry. Came Seminole, and then followed Kettleman Hills, which, for a time threatened the demoralization of the industry not only in California, but also throughout the United States and the rest of the world. Shortly thereafter, and before the industry could regain its equilibrium, came the discovery of Oklahoma City. And finally after the industry had made substantial headway in righting its course, and quite by accident, was discovered the great East Texas field with an area so huge as to engulf Kettleman Hills, Oklahoma City, West Texas, Seminole and others, all combined.

In the meantime the frantic search for petroleum was carried by American as well as by foreign oil men, throughout the world. First oil was produced in Italy in 1860, but important production did not develop until 1865, and the height of production came in 1911. First oil production in Canada occurred in 1862, but production on an enlarged scale did not occur until 1865 and reach its height in 1930 with a production of 1,300,000 barrels. Likewise in Russia, Poland, Germany and India discovery of oil occurred before 1890, but development really came after the advent of the automobile. Likewise the search for oil in South America met with greatest success between the years 1906 and 1930. Mexico had its day at Tampico. Then Venezuela took second place. Now under the driving force of the Five-Year Plan, the Russian Soviet has taken second place only to the United States in world crude production.

Thus the seventy-second anniversary of the discovery of petroleum finds the industry, particularly that part of it within the United States, presented with the problem of controlling a flood of crude undreamed of by those pioneers who prospected a dry creek bed in Pennsylvania.



Sources and Solid Carbon

By GEORGE REID
Associate Editor

THE accompanying discussion of liquid and solid carbon dioxide includes information taken from available literature having to do with the properties of the refrigerant, the various sources of the gas, different methods of extraction and concentration, and its compression for liquefaction and solidification.

Two units are discussed, one of which processes carbon dioxide removed from the flue where coke is burned in the furnace. This practice more similarly parallels the operation of the first unit to be constructed in the petroleum industry for the extraction of CO_2 from flue gases where natural gas is burned under boilers for the generation of steam with which to run the plant.

The second unit employs a newer absorbing medium and extracts carbon dioxide from a natural gas containing in addition helium and nitrogen but no hydrocarbons.

If production of solid carbon dioxide from natural gas proves commercially practical, and many authorities are of the belief that it will do so, it is possible that the industry may employ the processes, most of which are familiar to petroleum engineers, somewhat extensively. Certain of the process steps are also readily adaptable to the removal of hydrogen sulphide from refinery vapors.

MANUFACTURE of solid carbon dioxide (familiarly known as dry-ice) interests the refining industry chiefly because refiners are rather intimately acquainted with the process steps involved in the extraction and solidification of the gas, and secondly, because the installation of such equipment may add revenue to the business of refining and natural gasoline manufacture through the utilization of one of its waste products.

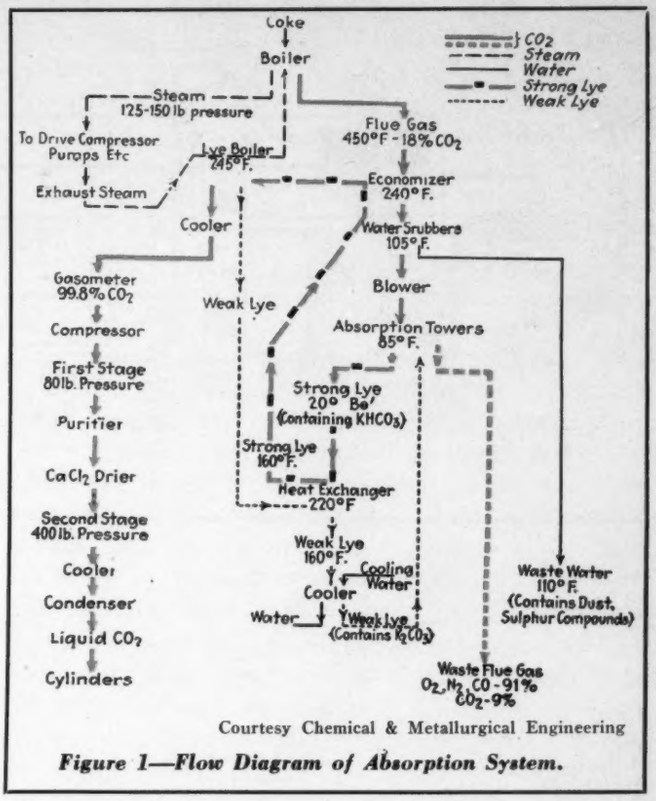
The process steps of absorption and compression are strikingly similar to conventional practice in natural gasoline or vapor recovery plant operation, and the equipment employed is of a similar nature. Problems of refrigeration and insulation are understood by the refining engineer. With the experience gained in absorption, compression, and refrigeration, it is not difficult to understand why engineers in the refining industry feel the urge to apply their technical knowledge to the young and growing industry of solid carbon dioxide manufacture.

With further development in distribution or merchandizing of the product it is not unreasonable to expect further exploitation of available processes by the manufacturing branch of the petroleum industry, especially at strategic points where other sources of carbon dioxide are not plentiful. Further development and simplification of processes will enable the refiner to operate profitably a liquid or solid carbon dioxide plant, which utilizes the gases of combustion from gas fired furnaces as a source of raw material.

Already one plant is being installed which will burn natural gas for the generation of steam with which to operate the plant and effect distillation, and which will extract the carbon dioxide content of the furnace gases to be solidified into "dry frost". This is the plant of the Carbonic Products Company, Inc., at Tulsa, which was erected by the Jackson Engineering Company, and employs the Girdler Process. (Ref. & N. G. M., August, 1931, page 131, also, Ref. & N. G. M., July, 1931, page 139.)

At this plant flue gases are trapped from the stack, and passed through an absorbing medium where the carbon dioxide is removed. Subsequent heating frees the CO_2 for further treatment or purification, after which it is compressed. Details of the process will be discussed later in this article. It is mentioned briefly here to note the simplicity of the processing steps. Other processes extracting carbon dioxide from various sources employ similar methods of extraction, and like methods of compression. Much of the equipment used by manufacturers is patented, as are certain of the processes. The Girdler Process Corporation owns one process. Others are The Silica Gel Process, The Backhaus Process, the Reich Process, The Carba Process, The Frick Process, and the

Manufacture of Dioxide



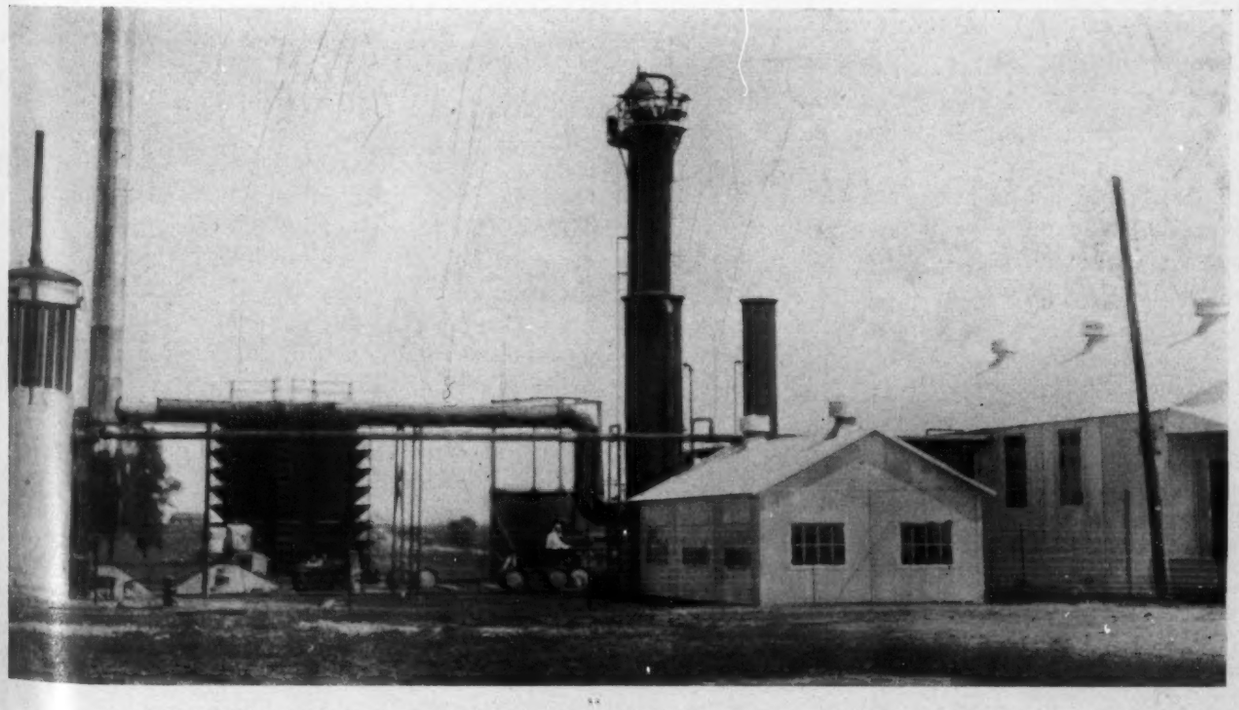
Courtesy Chemical & Metallurgical Engineering

Figure 1—Flow Diagram of Absorption System.

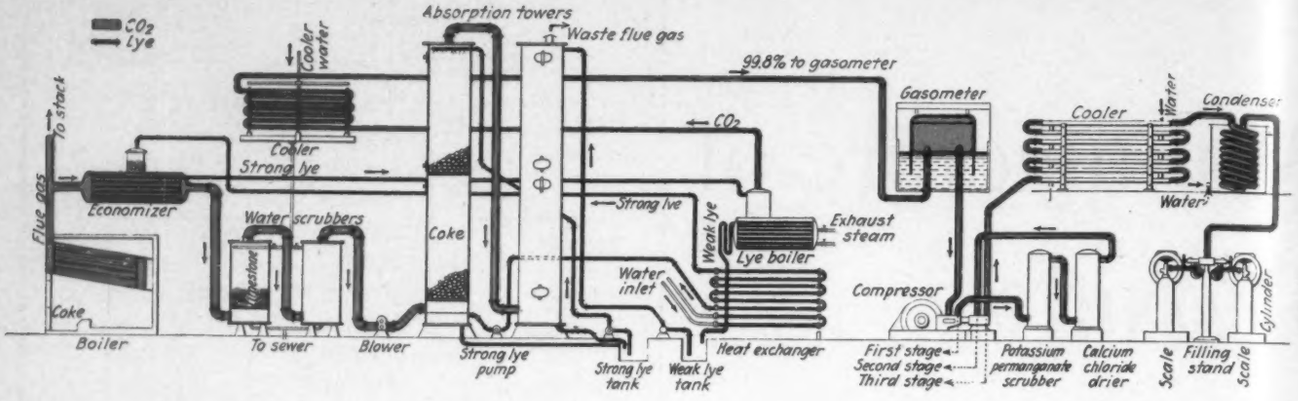
Dry Ice Corporation of America has various processes and patented features which it controls. Possibly there are others not revealed by the literature at hand.

Solid carbon dioxide has about twice the refrigerating effect of water ice, and under such conditions its commercial value would appear to be limited because of its higher cost. However, such properties as low temperature range, compactness, cleanliness, dryness, ease of handling, preservative qualities in gaseous form, and better heat insulation than air, are all points in its favor.

Liquid and solid CO_2 may be produced at the same plant, and in conjunction with one another. The 48 plants producing liquid carbon dioxide, as reported in 1929, derived their raw material as follows: Nine were using gas produced as a distillery by-product from the fermentation of molasses or grain; two by decomposition of magnesite by an inorganic acid; three by collection from natural springs; thirty-four



Plant of Carbonic Products Company, Inc., at Tulsa, Oklahoma, for the Manufacture of Carbon Dioxide from Natural Gas.



Courtesy Chemical & Metallurgical Engineering

Figure 2—Standard CO_2 Absorption System

by thermal decomposition of carbonates, or by burning coke. (Reich, Chem. & Met. Eng., Vol. 38, No. 3, March, 1931, page 136.) Solid CO_2 is manufactured in 25 plants, 80 per cent being operated by the Dry-Ice Corporation of America and the remaining 20 per cent by several other companies. Solid carbon dioxide was made in ton lots by Reich in 1922, in California, but its commercial exploitation began in 1925 according to Slate patents, when its production amounted to 270,000 pounds. (Compared to the estimated production of 85,000,000 pounds in 1931.)

Mitchell states that the principle sources of carbon dioxide gas are coke fires, fermentation vats, lime kilns, and "oil" wells. (Ing. & Eng. Chem. Vol. 23, No. 5, May, 1931, page 523.) The oil well reference has to do with wells producing carbon dioxide in old Mexico and Colorado.

PROPERTIES AND SOURCES

Carbon Dioxide gas is 50 per cent heavier than air, is nearly odorless, and is non-explosive and non-poisonous. Solid CO_2 goes directly into the gaseous state, as compared to water ice, which is converted first into liquid before it becomes steam. This difference is one of the advantages which enabled solid carbon dioxide to replace water ice in many instances. In the table below are some of the physical properties compared to water ice at atmospheric pressure (Reich, Chem. & Met., Vol. 38, No. 5, May, 1931, page 270).

	Solid Carbon Dioxide	Water Ice
Specific gravity	1.53	0.99987
Melting point or sublimation point	—109.6° F.	32° F.
Boiling point		212° F.
Critical temperature	88.43° F.	689° F.
Critical pressure	1,071 lb. abs.	2860.6 lb. abs. at 32° F.
Latent heat of fusion	82.0 B.t.u.	144 B.t.u.
Latent heat vaporization	158.6 B.t.u.	1074.29 B.t.u. at 32° F.
Weight per cu. ft. gaseous product at 32 deg. F.	0.117 lb.	0.000304 lb.
Weight per cu. ft. solid*	90 lb.	57 lb.
Latent heat of sublimation	248 B.t.u.	
Refrigerating effect	275 B.t.u.	144 B.t.u.

*Based upon solid CO_2 marketed at present.

The usability of any of the various processes for the preparation of liquid or solid carbon dioxide is affected more by market conditions and cost of power and fuel rather than the source of raw materials. (Jones Chem. & Met. Vol. 37, 416, 1930.) Regardless of which raw materials used the CO_2 which is to be liquefied must have a purity of 99.7 per cent. The gas is available from a number of sources as listed above and in yields of less than 40 per cent ranging upward to 99.7-100 per cent with slight impurities, and therefore special equipment is required which differs according to the source of raw material. In America 70 per cent of the producing plants are using the absorption process.

ABSORPTION PROCESS

The description of the absorption process that follows is taken from Reich's discussion of liquid carbon dioxide (Chem. & Met. Vol. 38, No. 3, March, 1931, page 136) and assumes that coke is the raw material.

"Coke used in this system should be capable of easy handling without disintegration. A 48-, or preferably a 72-hour foundry coke usually is used; sometimes a combination of both where a reduction of cost is practical. The coke is burned under specially designed boilers. Here the heat given off serves for the generation of steam as a motive power for all the machinery and the flue gas yields the CO_2. The flue gases obtained by careful combustion contain 17-18 per cent carbon dioxide. The flue gases will also contain oxygen, some carbon monoxide, nitrogen, sulfur compounds, organic matter and dust.

"As shown in Figure 1, coke serves two purposes: for the production of CO_2 obtainable from its flue gases, and then for the production of steam at 125-150 pounds pressure in burning underneath the boilers. The stack, Figure 2—is provided with dampers which permit the discharge of low-purity flue gases into the atmosphere and which are closed when recovery is desired. The flue gas coming from the boilers is purified in three stages: removal of sulfur

compounds and dust; removal of all other gaseous impurities; and, in some instances, removal of organic matter and moisture.

"For removal of sulphur compounds and dust so-called "water scrubbers" are being used. They may be built out of wood, iron, or iron tanks lined with concrete to resist the corrosive action of the impurities. The tanks are provided with perforated bottoms, or grids, which support the limestone packing. The gas is thoroughly washed in this scrubber—usually two are in use—before it enters the absorption towers. The scrubbing medium is water.

"The flue gas, which in some instances may pass through an economizer before it enters the water scrubbers, is drawn by a fan placed between the scrubbers and the absorption towers in counter-current direction. The water, which for economical reasons is taken from the coolers, trickles over the limerock, where it absorbs the sulphur compounds and also removes the dust. The limestone serves as a tower filler and reacts with the sulphur compounds to form a water-soluble product which is carried into the sewer.

"As the water, besides being the scrubbing medium, also cools the hot flue gas, its temperature on entering and leaving the scrubbers must be controlled carefully. In practice, it enters the scrubbers at approximately 85° F. and leaves at 105-110° F. The flue gas enters the scrubbers around 250° F. and passes into the absorber at a temperature of 85°.

"The second step of this process consists of the removal of gaseous impurities such as oxygen, carbon monoxide, and nitrogen, which are present in a ratio of one part CO_2 to 4.6 parts of impurities. The removal is accomplished by means of an alkali carbonate solution in the absorption towers. Either potassium carbonate or sodium carbonate is used for this purpose. Because of their different solubilities in water in their form as carbonate and bicarbonate, the solution containing sodium carbonate has a lower concentration than the potassium carbonate solution. Both are called "lyes"; the former has a density of 16° Be. and potash lye has a density of 20°.

"The sulphur- and dust-free CO_2 is drawn by a blower from the water scrubbers and is forced into the absorption towers, usually two in series. The dimensions of these towers, for a five-ton daily liquid plant, are nine feet in diameter and 50 feet high; a 10-ton plant requires towers 12 feet in diameter and 55 feet high. The towers contain grids which support 2x3 inch, 72-hour hard-burned foundry coke and are provided with a few liquid distributing plates.

"The carbon dioxide is led into the bottom of the absorption towers and liquid is circulated in counter-current principle, absorbing part of the carbon dioxide and the unabsorbed gas with other insoluble gases passes into the atmosphere. The solution entering the towers is called "weak lye", but after absorbing part of the carbon dioxide it is called "strong lye." Pumps are circulating the liquor through the towers and are delivering the "strong lye" first into the heat exchanger. The temperature at which the towers are operating should not exceed 115° F. When sodium carbonate is the absorbent, the solution contains 7.5-8 pounds and when potassium carbonate is present, 12.3 pounds per cubic foot.

"For every 1,000 pounds of CO_2 per hour produced, approximately 120 gallons per minute of sodium carbonate lye is required. The flue gas gives up its CO_2 up to about nine per cent, which can be recovered under pressure, requiring a great deal of power.

"Chemically, the absorption system consists of two reactions: First, the alkali carbonate is converted into bicarbonate in the absorption towers, and then is reconverted in the lye boiler, liberating the absorbed gas:

Weak Lye Absorption Towers Strong Lye

(1) $Na_2CO_3 + H_2O + CO_2 = 2\,NaHCO_3$

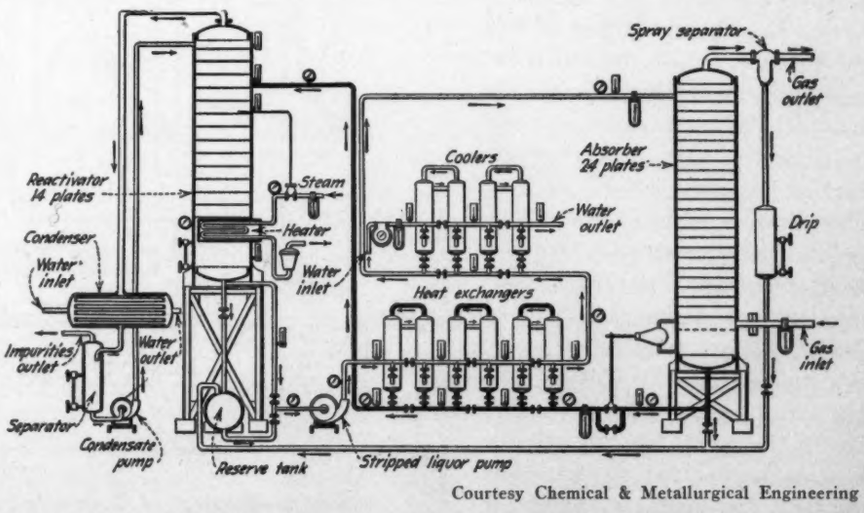
106 lbs. 18 lbs. 44 lbs. 168 lbs.

Strong Lye Lye Boiler Weak Lye

(2) $2NaHCO_3 + \text{Heat} = Na_2CO_3 + H_2O + CO_2$

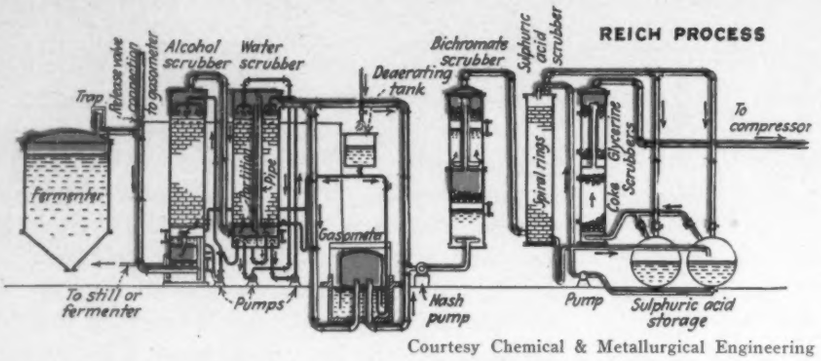
168 lbs. 44 lb.

"The cold strong lye passes first through the inner pipe of a double-pipe heat exchanger and the hot



Courtesy Chemical & Metallurgical Engineering

Figure 3—Gas Purification Layout at Thatcher, Colorado, Plant of The Helium Company, Using Triethanolamine as Absorbent.



Courtesy Chemical & Metallurgical Engineering

Figure 4—Reich System of CO_2 Purification

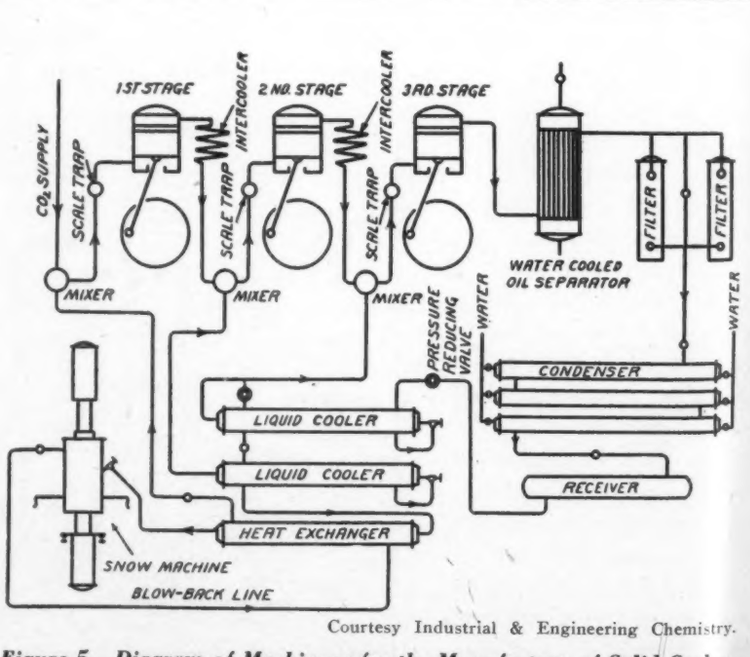
weak liquor entering at 220° F. travels in the annular space between the pipes and gives up part of its heat to the strong lye. The preheated strong lye goes to the economizer or in some instances direct to the lye boiler. The utility of the economizer is sometimes doubted, as the gain made by the recovery of part of the heat from the flue gas is offset by the collection of soot and other difficulties which are encountered with apparatus utilizing waste heat. The economizer consists of a shell and is provided with steel tubes of sufficient diameter to permit an easy travel of the flue gas. Outside the tubes the strong lye travels, cooling the flue gas from 450 to 250° F.

"The preheated strong lye now enters the lye boiler, a cylindrical drum provided with steam coils and heated with exhaust steam coming from the compressor, pumps, and so on. Sometimes live steam is used when electric current serves for driving the various equipment. The pressure of the exhaust steam is around 15-20 pounds. Live boilers are also heated directly by burning coke in the furnace. Which method is the most economical depends on the cost of fuel and power, as the utilization of high-pressure steam may offset any benefit derived from other sources. The strong lye flowing continuously from the heat exchanger, or economizer, into the lye boiler is heated to 245°F. The gas liberated (as in Equation 2) generates 8-10 pounds pressure per square inch and forces the weak lye through the heat exchanger and the CO_2 first through the analyzer, which is part of the lye boiler and consists either of plates arranged with downtake pipes or filled with coke. The escaping gas of high purity pre-heats the strong lye entering the analyzer and then passes through the water cooler into the gasometer. The cooling coils are long parallel lengths of pipe connected to form a continuous pipe. The gas, heated to a high temperature, is saturated with water and, as it passes through the cooler, the moisture is condensed and is returned to the weak lye, in order to maintain its proper concentration. From the gasometer the gas is led to the compressor.

"This general description of the absorption system shows that success depends on the highest concentration of flue gas, absorption of CO_2 per cubic foot of lye, and maximum dissociation of the alkali carbonate solution. The total power required in an absorption plant per ton of liquid CO_2 produced is approximately 25 horse power, and the coke consumption is 0.85-1.25 pounds per pound of liquid gas."

TRIETHANOLAMINE

In the same article from which the foregoing was quoted Dr. Reich discusses other and newer absorbents such as triethanolamine, as well as other processes such as that of Backhaus, Silica Gel, and



Courtesy Industrial & Engineering Chemistry.

Figure 5—Diagram of Machinery for the Manufacture of Solid Carbon Dioxide, According to Terry Mitchell, The Frick Company

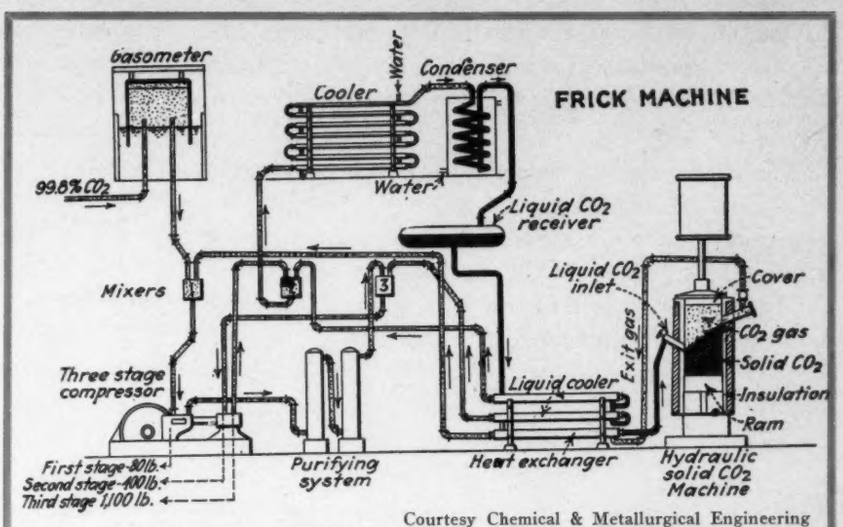
his own, or the Reich process, and the details of these processes can be secured from the reference cited. Recently, R. R. Bottoms, director of research, The Girdler Corporation, presented a discussion of experiments carried out by his company for the determination of a more efficient absorbent than the alkalies commonly used. (Chem. & Met., Vol. 38, No. 8, August, 1931, page 465.)

This work points to the fact that the first of the continuous closed-cycle process studied used potassium carbonate for scrubbing, followed by boiling the bicarbonate solution formed, in order to disengage the carbon dioxide. It is reported that laboratory tests indicated that with this method it would be practical to reduce the carbon dioxide content to about 0.1 to 0.2 per cent. It was found, however, that so much solution was required that the heat needed for its reactivation would be uneconomic. This led to the search for a more suitable absorbent. "Such an absorbent should have the following characteristics: (a) absorb CO_2 readily and in large volume; (b) release CO_2 readily at relatively low temperatures; (c) be stable in the presence of the constituents of the gaseous mixture and materials of construction at the boiling temperature of the solution; (d) have vapor pressure, either in solution or free, low enough to avoid loss of the material due to evaporation."

It was the desire of The Girdler Corporation to secure such an absorbent for the removal of about 0.3 per cent carbon dioxide from gas treated by its subsidiary The Helium Company at Dexter, Kansas, and 15 per cent of this gas from the helium gas produced at its Model Dome operations at Thatcher, Colorado. Of a large number of compounds investigated it was found that the ethanolamines, diethanolamine and triethanolamine, possessed the characteristics required.

The use of this absorbent and the processing steps are described by Dr. Bottoms, as follows:

"In operations using diethanolamine for the absorption of carbon dioxide, a 50 per cent water solution has been found to be entirely satisfactory. The molecular weight of diethanolamine is 105 and it is a mono-acid base. Theoretically, then, 105 gr. of diethanolamine should absorb 22 gr., or 11 liters, of carbon dioxide. This would amount to about 110 c.c. of carbon dioxide to each cubic centimeter of diethanolamine, but since some dicarbonate as well as neutral carbonate is formed, a 50 per cent solution will absorb about 72 volumes per volume of solution when the partial pressure of the carbon dioxide over the solution is equal to one atmosphere and the temperature is about 35° C. (95° F.)



Courtesy Chemical & Metallurgical Engineering

Figure 6—Details of the Frick Machine for Compression of Carbon Dioxide Gas and Subsequent Compression of Carbon Dioxide Snow into Square Blocks Weighing 40 to 50 Pounds.

The heat liberated due to the absorption and reaction of carbon dioxide in diethanolamine has been determined experimentally to be 650 B.t.u. per pound of carbon dioxide absorbed. This heat of reaction for hydrogen sulphide, on the other hand, is 511 B.t.u. per pound of hydrogen sulphide absorbed. In heating solutions of diethanolamine to drive off carbon dioxide or hydrogen sulphide after absorption, a certain quantity of water also is vaporized. This quantity of water corresponds to the quantity of water saturating the carbon dioxide at the temperature at which it leaves the solution. Heat sufficient to vaporize this quantity of water then must be introduced into the reactivating kettle in addition to the quantity corresponding with the amount of heat generated upon the absorption of the gas by the solution. By calculating the quantity of water driven off during this reactivation period from a given quantity of solution, and the heat necessary to dissociate the carbonate as well as raise the temperature of the solution from the inlet temperature to the boiling plant, the total heat required in the process for reactivating the solution can be accurately determined.

"It has been found experimentally that when a solution of diethanolamine saturated with CO_2 it heated to 95° C. (203° F.) about 90 per cent of the total carbon dioxide absorbed in the solution may be eliminated. In liberating the other 10 per cent of carbon dioxide it is necessary to boil off a small quantity of water. When a solution of diethanolamine saturated with carbon dioxide is heated an active liberation of the carbon dioxide begins immediately. By the time the boiling point of the solution is reached it is found that almost all of the carbon dioxide has been liberated.

"Practical operation of the absorption process is shown in the diagram of the helium production plant of The Helium Company, Thatcher, Colorado, (Figure 3). This installation reduces the carbon dioxide content of

the gas on the average to about 0.01 per cent. The original composition of the gas at Thatcher is carbon dioxide, 15; helium, eight; hydrocarbons, 0; and nitrogen, 77 per cent.

"The system operates as follows: Gas is delivered to the plant at about 350 pounds pressure, enters the absorber and passes up countercurrent to the descending amine solution, where the carbon dioxide is almost completely stripped from the gas. The solution of amine carbonate passes out of the base of the absorber, through the heat interchangers countercurrent to the reactivated solution of amine from the reactivator, and in this heat interchanger the temperature of the solution is raised to about 80° C. (176° F.) The solution then passes into a mid section of the reactivator tower, down over the bubble plates, and finally reaches the kettle of the reactivator, which contains steam coils where the solution is held at its boiling point. The steam from the kettle passes through the bubble plates countercurrent to the descending solution, removing the carbon dioxide.

"Some of the steam progressively condenses as it meets the descending colder solution, heating the solution to its boiling point and disengaging the carbon dioxide as it approaches the base of the tower. The disengaged carbon dioxide passes to the condenser at the top of the reactivator, where the water vapor saturating the carbon dioxide is condensed and the condensed water passed back to the top of the tower. The carbon dioxide passes out of the condenser and in this particular instance is permitted to go to waste.

"The reactivated solution is then pumped out of the kettle and passed through the heat interchanger countercurrent to the cold saturated solution from the absorber and then to the precooler, where the solution is cooled to a temperature of about 40° C. (104° F), and then back into the top of the absorber. This operating temperature has been found to be entirely satisfactory for carbon dioxide removal. The reaction seems to be more rapid at this than at a lower temperature; consequently more complete removal of carbon dioxide is obtained. If a temperature higher than 40° C. (104° F.) is used the partial pressure of the carbon dioxide over the amine carbonate solution is increased and consequently the removal of carbon dioxide from the gas per unit volume of solution is adversely affected; therefore the circulation of a larger quantity of solution is required to obtain equivalent separation.

"The question of the stability of the ethanolamines when used as an absorbent for carbon dioxide has been settled through the experience of The Helium Company in the operation of its carbon dioxide removal system at Thatcher, Colorado. It has been mentioned before that the carbon dioxide content of the gas at Thatcher is reduced to less than 0.01 per cent. This residual trace is then removed by further scrubbing with caustic soda solution. In the use of a caustic soda solution in the cycle care must be exercised that the triethanolamine solution does not become contaminated by the caustic. Caustic soda has such a damaging effect on the triethanolamine solution that a contaminated mixture cannot be used. But approximately 75,000,000 cubic feet of gas has been passed through the Thatcher system without any decrease in quantity of solution or in its absorption efficiency.

"The success achieved with this process at this plant has demonstrated that it can be used to advantage in the separation of carbon dioxide from other industrial gases. The process also is successfully used for the separation of hydrogen sulphide from natural gas, refinery gas, and other industrial gases."

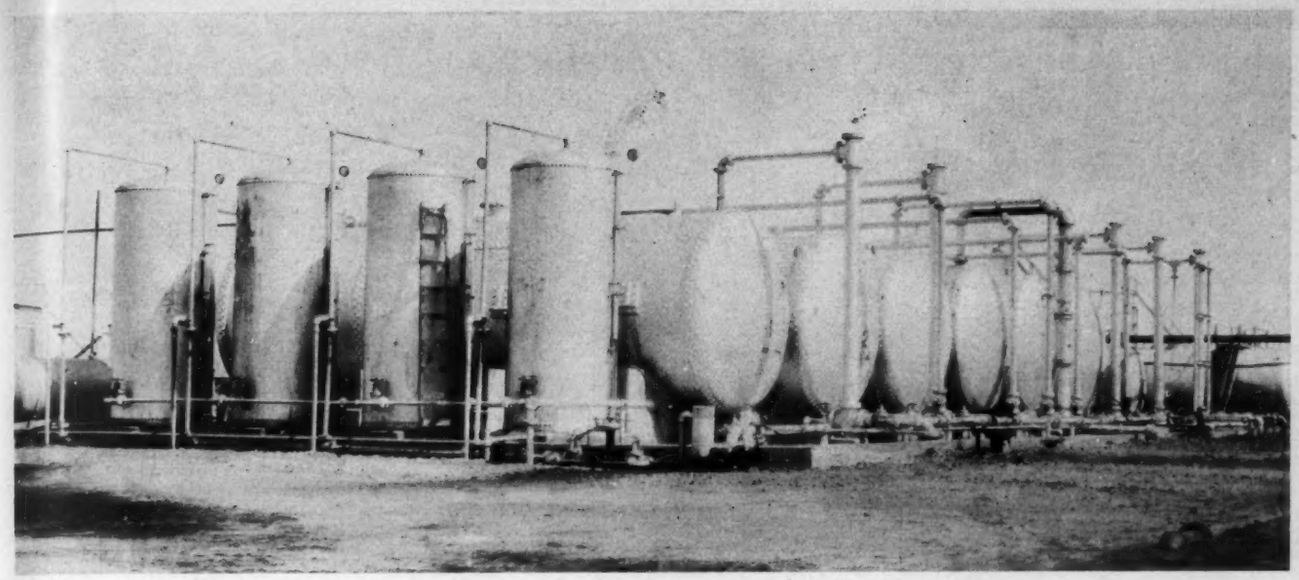
Since the plant of Carbonic Products Company, Inc., Tulsa, manufacturing "Dry Frost" from natural gas, through extraction of CO_2 from furnace gases, and employs the latest type of absorption system for the extraction of the CO_2 from these furnace gases, it is thought that the commercial utilization of diethanolamine will be definitely determined in the operation of this plant, in so far as it concerns the manufacture of solid carbon dioxide from natural gas. Its value has been proven elsewhere by the owners of the process, with carbon dioxide derived from different sources.

SOLIDIFICATION

No matter what the extraction and concentration steps may be, gaseous carbon dioxide to be converted to solid carbon dioxide, is finally led to the compressor, after purification and deodorization. Compression consists of three stages, using either the vertical single acting enclosed type each with two cylinders, or the horizontal double acting design. Where large capacity exists duplex-coupled enclosed machines are used, driven by a single synchronous motor placed between them, for the first stage compressing to about 80 to 100 pounds. The second stage compresses the gas to 400 pounds, and the third stage compresses to 900 pounds per square inch.

In some instances the purification system is placed between the first and second stages, and may consist of a scrubber containing potassium permanganate for the oxidation of organic impurities, and the second scrubber contains fused calcium chloride for dehydration purposes. (Reich, Chem. & Met. Vol. 38. No. 3. Mar. 1931, Page 136-141). Sometimes the latter is replaced by a dehydrator, being cooled sufficiently low, whereby dry CO_2 is obtained. The solid CO_2 and refrigeration plants prefer the later method. During compression it is necessary to have good cooling as the gas is above its critical temperature of 88.43° F., therefore it passes first into the cooler and then into the liquefier which is

(*Continued on page* 92)



Continuous Treating Plant. Acid Treating with Ammonia for Neutralization.

Ammonia for Neutralization In Treating

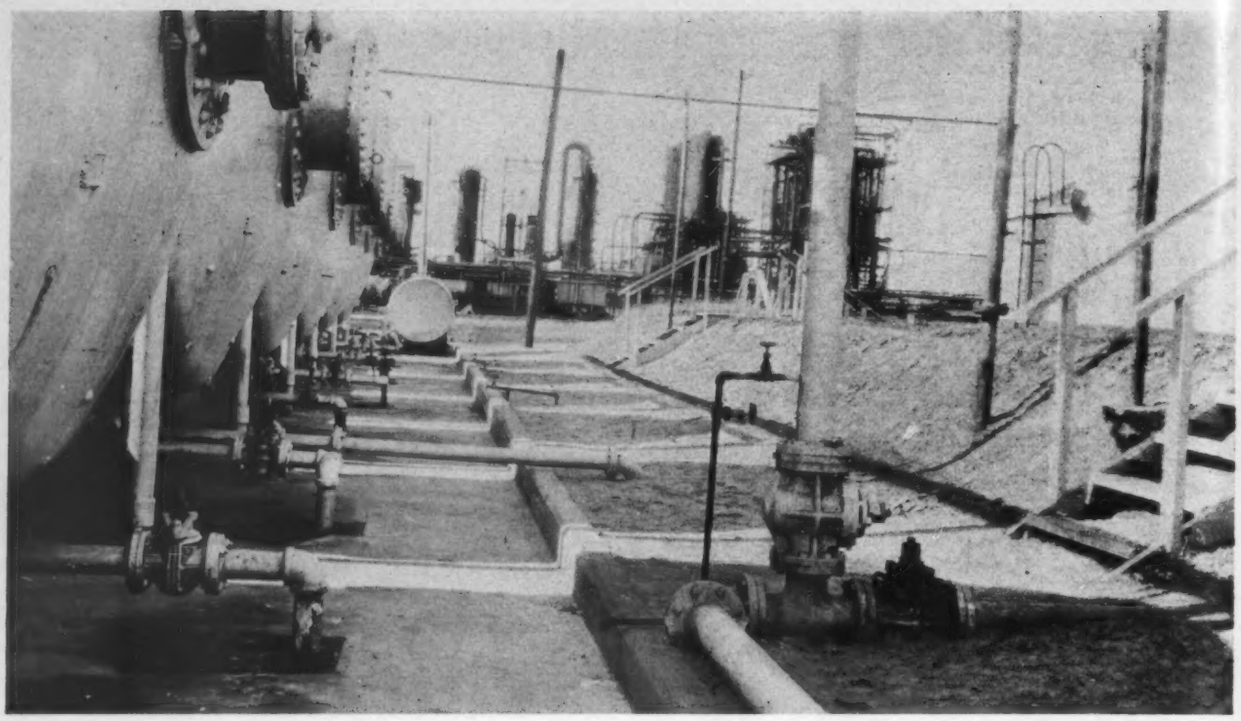
By J. C. ALBRIGHT

LOSSES resulting from treating the pressure distillate, derived from the battery of nine cracking units, in the obsolete batch agitators was a spur to the management of Louisiana Oil Refining Corporation at its Bossier City refinery to secure a more efficient method of treating product previous to rerunning for color and end point. It was realized that the continuous systems coming into use were more fool proof, but the corrosion of tankage from contact with spent or weak acid was a deterrent to the installation of light steel tanks. Therefore, before attempting to install a system of this kind for this particular use when the pressure distillate was recovered from a reduced crude carrying a heavy amount of corrosive materials, the operators looked around for tankage that would withstand deterioration to a marked degree, which would materially lengthen the life of the equipment.

The refinery superintendent knew of equipment that could be had at a low figure, and at the same time was of stock heavy enough that it would withstand pitting for a great length of time before it would become necessary to repair or replace the tankage or treating drums. Securing a battery of heavy pressure stills that had been discarded, they were shipped to Shreveport to be used as the principal units in the new continuous system. These vessels are 10 feet in diameter by 30 feet in length, fabricated from one-inch steel. Five of these were installed in the system by which the pressure distillate could be subjected to treatment with sulfuric acid with a caustic neutralization after wash. Set on cement cradles, the rest of the unit was built around them.

At one end of the five treating drums, were set four, 5x12 feet vertical steel tanks to be used as blow cases containing the working storage of acid used in the process. These tanks or blow cases were connected in pairs, the outlet from each two in the battery being connected to the two-inch line leading to the first contact column. The feed line leading to the blow cases are connected in the same manner, leading to two at the same time. However, only one of the individual blow cases is being evacuated of its acid during the treating period. An air line leads from the central air generation station to this battery to maintain a constant pressure on the cases, so that the operator may be sure of feeding the proper amount of acid to the column at all times.

At the raw pressure distillate, storage tanks was set another one of the 10x30 heavy tanks by which the material can be given a pre-caustic wash before it is delivered to the light oil treating plant, as it is termed in this plant This was decided upon for two reasons; the first was that by so treating with a caustic bath before treating, corrosion could be kept



Details of Assembly, Piping, of Continuous Acid Treating Plant Shown from the Rear.

to a minimum. The second was that the low molecular weight mercaptans could be removed to some extent.

Over a period of three months, a careful check was made covering the results obtained from the pre-caustic wash in this plant running with an average of 6,720 barrels of raw distillate per day, using two tenths of a pound of caustic per barrel of feed. By treating between the rundown tanks and the raw distillate storage prior to treating in the light oil treating plant with acid, the pre-caustic wash was found be an economical installation, by reducing the caustic requirements an average of from one to two pounds. By the pre-caustic wash, the following was found:

Sulfur removal as follows:

Hydrogen sulfide removed	.010
Mercaptan sulfur removed	.020
Total	.030

By removing the caustic-washed pressure distillate from the storage tanks with a Union duplex 12x9x18 steam pump, the material is fed into the first contact column at the light oil treating plant. Acid is placed in the base of the same column on the opposite side from the entry of the distillate. The column is made from eight-inch pipe, set on a Walworth eight-inch flanged cross, the bottom of which is set on a concrete stool to support the column. On the acid entry side the line is made up of two-inch pipe connected to the cross with a bolted reducing flange, with a gate valve and swing check near to prevent a back flow of distillate from the contact column to the acid blow cases, should the pressure be released from any cause.

Within the contact column are spiral contractors placed on a rod. The top of the contact column is closed by a flanged tee, running, the top end sealed with a bolted blind flange. The side outlet of the top tee is connected by a reducing flange to the four inch line leading the distillate and acid to the first treating drum. The distillate, being lighter than the sludge formed in the contact column rises through a four-inch outlet at the back of the tank to enter the second tank at the front; from there it is removed at the back to be led over to the front of the third tank as in the other cases. Removal of acid sludge is provided for at the front of the first tank, and is blown to a storage tank from which it is pumped to the furnaces under one of the cracking units and burned. A periodical check is made on the second and third tank to ascertain the amount of sludge carried over in suspension or mechanically. This small amount from the two settling tanks is drained from the back of the tanks and is led away to the sewer.

The acid treated distillate is led through from the back of the third tank to a contact column 10 inches in diameter in front of the fourth tank where a stream of water is passed with it through the column having two 10-inch Duriron mixing nozzels placed in it. Three were originally installed, but by testing, two were found to give results. Results obtained by contacting with this type of mixing nozzel are such

that as soon as it is necessary to remove the original vanes on rods from the other columns, these will be placed in operation instead of the ones now in use.

AMMONIA AS NEUTRALIZER

From the fourth tank, the settled water-washed distillate is led to the fifth tank through another contact column. Here is where an experiment has been carried out that is of interest. By having used a caustic wash in this column to neutralize the acid left in the distillate after the water wash, three tenths of a pound of caustic was found necessary to obtain the desired results. But, having used anhydrous ammonia in the distillation of the pressure distillate in the re-run unit, the question arose concerning the advisability of using ammonia in the fifth tank instead of caustic.

After the experiments had been carried out to their satisfaction in the rerun unit, by using this anhydrous ammonia from cylinders, it was found to be much more economical to purchase it in special tank cars. The car is spotted on a spur built in the yard near the re-run unit and the pressure distillate treating plant. From this car, a line was laid so that it could be connected to the unloading connections on it, leading to the rerun unit and to the light oil treating plant. No auxiliary tankage is provided for this material, as it has been found economical to retain the tank car on the spur until it was emptied, paying the demurrage and car rentals, rather than build special tankage to hold the ammonia.

Instead of using caustic in the fifth tank at all times, the experiment is still being carried out with ammonia for a neutralization agent. Air is provided to maintain a constant pressure on the tank of ammonia after it has been partially unloaded so that a stream of it may be utilized which will not vary in volume or pressure. A one-inch line was liad up to the original caustic feed line, and the ammonia line was connected to it between the control gate and the block gate at the base of the contact column. Control of the ammonia feed is through a one-fourth inch line placed in a tee. Several Crane special ammonia valves were placed in the one-inch line by which a secure shut off could be obtained at any time. By checking with the laboratory against the rate of feed of ammonia per barrel of pressure distillate, the treater is able to introduce just enough ammonia that the distillate leaving the tank is slightly alkaline. It has been found that treating with ammonia compares favorably with caustic in price and results obtained. This could not be done by purchasing it in cylinders, because the cost of obtaining it in this manner is prohibitive.

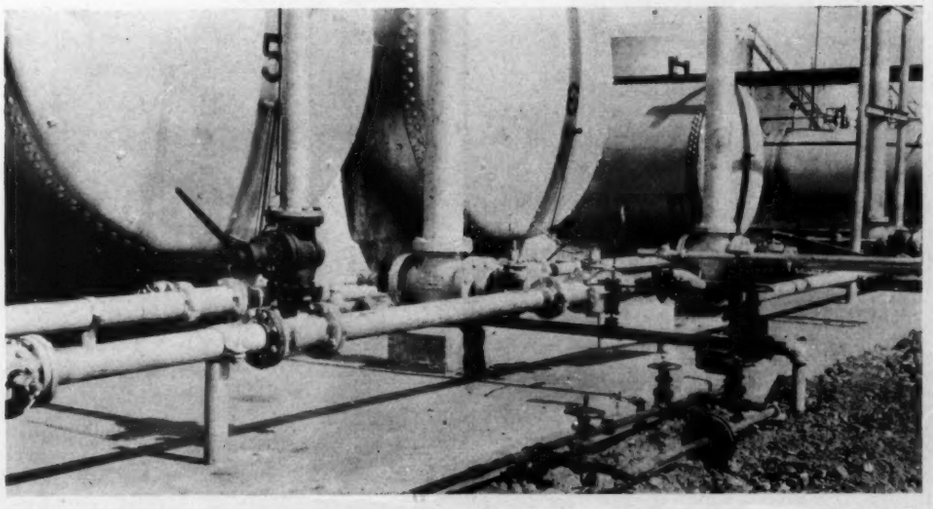
Another factor in favor of ammonia, is that practically all of it is retained in the gasoline, or pressure distillate, and serves to reduce the amount used in the rerun unit to counteract the acidity formed by the heat in the stills.

The results of the continuous treating plant is given in the following analysis of the product before and after treating.

Pressure Distillate

	Before Acid Treatment.	After Acid, Water and Ammonia Neutralization.
Gravity	53.6	52.8
I. B. P.	100	102
End point	446	476
Recovery	96	96
@ 410	88.5	87.5
Color	Lemon	Cherry
Doctor	Sour	Sour
Corrosion	Bad	Slight
Sulfur	.24	.21
Acid in water wash number four tank		0.45
Acid in spent acid sludge		49.7

After the pressure distillate has been treated in this plant, it is placed in storage under the process pressure to await re-running through the three-stage distillation unit for color and end point.



Detail of Ammonia Control in Treating Plant.

Processing Still Bottoms For Road Oil

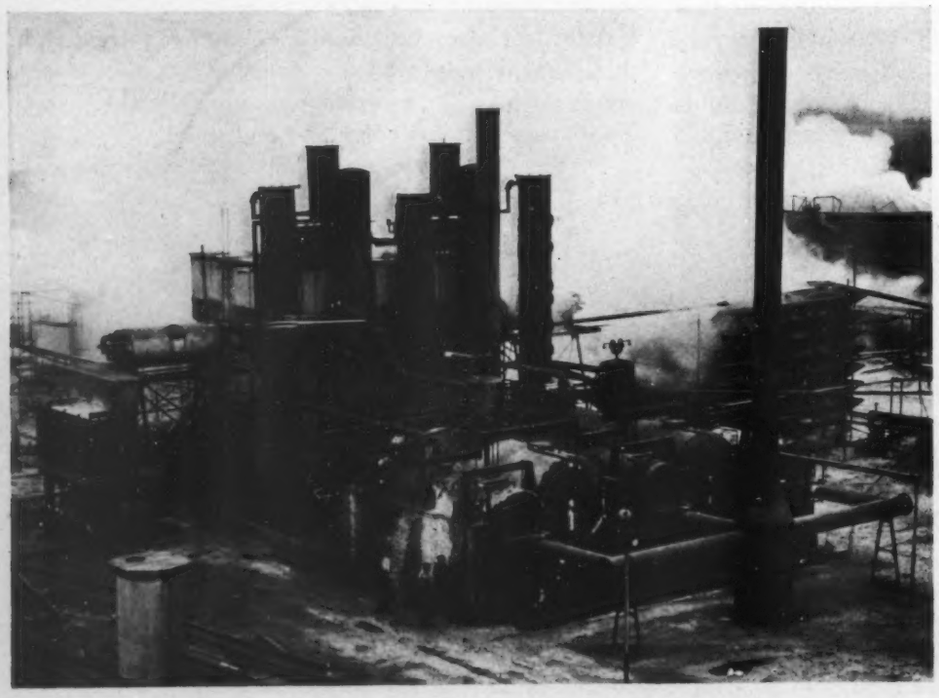
BEING situated near a pool that produces a crude oil that is particularly adapted to the manufacture of road oils, led Sunray Oil Company to process still bottoms to provide this commodity.

The oil pumped from the wells in the vicinity of Allen, Oklahoma, is of a mixed base with asphalt predominating, but in refining it does not require an intricate or especially involved process to manufacture a product whose constituents have been meeting the requirements of most of the specifications covering this class of material.

After operating the refinery for the past 10 years as a skimming plant, the equipment has been gradually changed until the residuum leaving the shell still battery is a finished product which requires no blending, rerunning or any additional processing.

Running on full throughput, the equipment is able to handle 2500 barrels of 29/31 gravity crude oil per day. manufacturing from this charge 18 per cent low gravity low end point relatively high benzol equivalent gasoline, for which a premium is received; 20 per cent distillate, 24.2 per cent gas oil and the residuum 37.8 per cent, an 18/20 gravity oil suitable for road building.

The shell stills are five in number, two of which are eight feet in diameter by 24 feet in length, ordinary shells, while the other three are combination shell-tube stills five feet six inches in diameter by 20 feet in length, containing 18 three-inch tubes each. The two larger stills are fired in the regulation manner with the gasses from the combustion chambers leaving through ducts in the back to a common stack placed between the still setting and the receiving house. The three smaller stills are fired through combustion chambers under the bottoms, but the hot gases return through the tubes to enter breeching leading to a common stack situated near the front of the still battery.



Shell Still Plant of Sunray Oil Company, Allen, Oklahoma

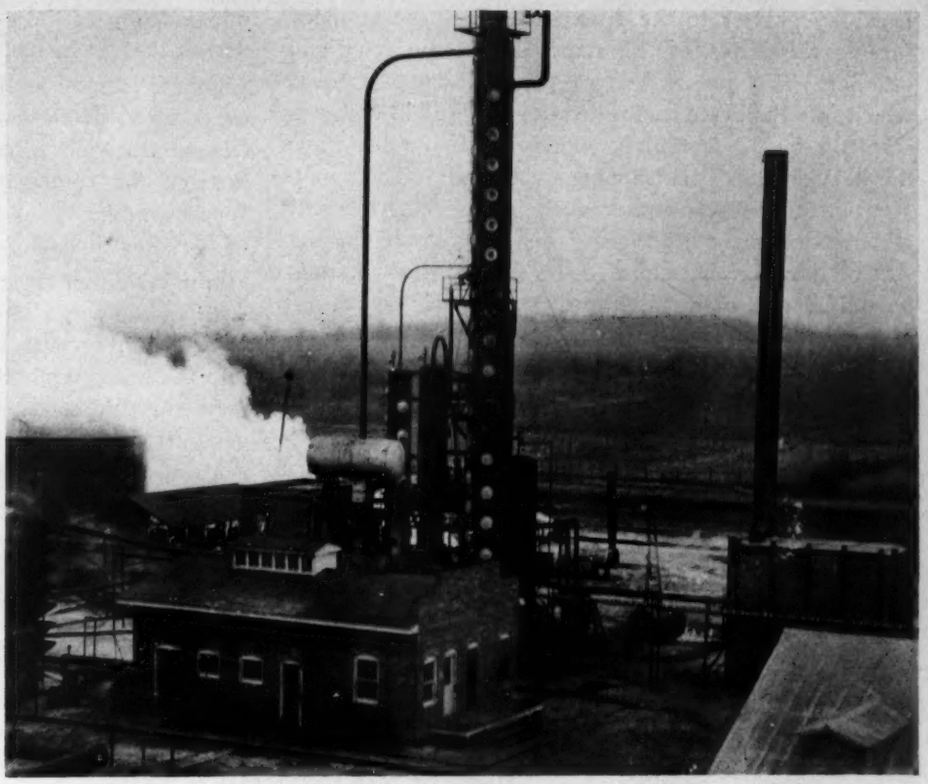
CONDENSATION AND COOLING

Dutch ovens are provided for all five of the stills, heat being made available through the combustion of natural gas burned from mixers made on the refinery property. They are of the multi-jet type, placed in the front of the ovens to project part way through two-inch openings built in the brick filler. Firing is controlled by manual operation, but the recording charts show a close adherence to the predetermined temperature required in the process.

Four towers are in operation to provide fractionation of the various cuts taken from the crude. Condensation and cooling are effected through the usual submerged pipe coils for the heavier fractions, but the gasoline vapors are re-

duced to a liquid through the utilization of internal tubular condensers made locally to the specifications of the company's engineers. These coolers are assisted at times by auxiliary submerged pipe coils.

The oil which composes the charging stock is delivered to the plant storage battery containing small amounts of fine floating sand with some salt water in suspension. The amount of both is less than one-half of one per cent, but that small amount is difficult to separate from the crude body by ordinary methods. The charging stock upon being placed in the line leading to the stills, passes first through a small horizontal tank which performs the duty of a partial condenser of the exhaust steam from the pumps, and transferring heat to the oil.



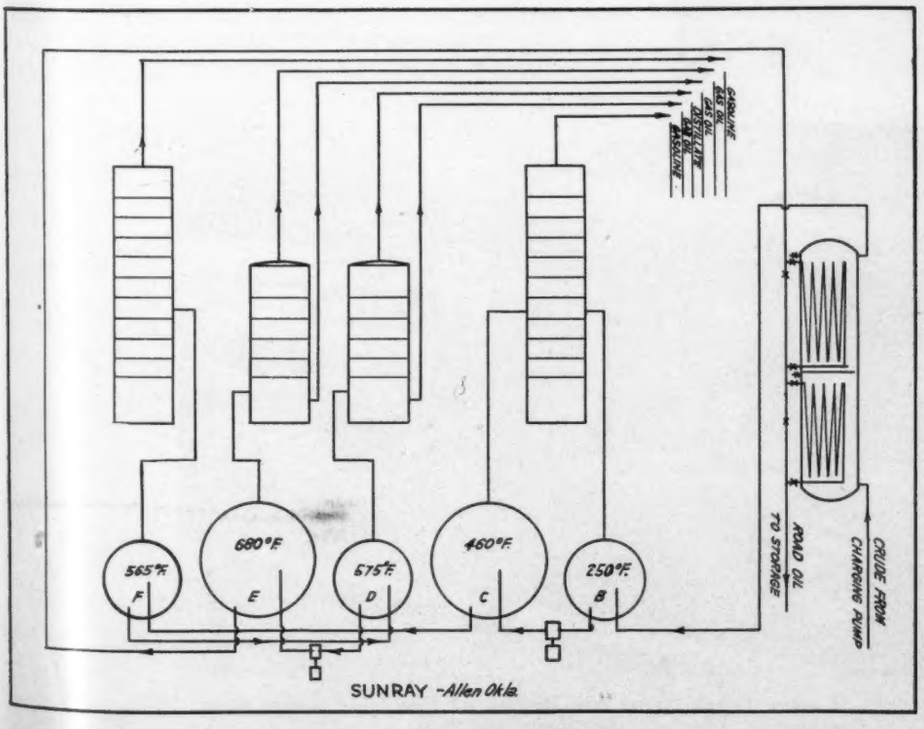
Southwestern Skimming Plant Recently Erected at Allen, Oklahoma

Leaving this condenser, it is led to a sand and salt water separator, which acts also as a degasifier and heat exchanger. This apparatus consists of a horizontal shell five by 40 feet, containing two tube banks, 64 one-inch ordinary line pipe tubes to the bank. The oil passes into the shell in counter current to the flow of the residuum from the last shell still, where it is heated sufficiently to effect a separation of the entrained sand and salt water. This separation is assisted materially by the reduced velocity of the oil as it travels through the shell and over a baffle placed in the center.

STILL PRACTICE

Leaving the tank at the opposite end from which it entered, the oil has acquired a temperature of 225°F. and enters the first shell-tube still where it is further heated, raising the temperature to 250°F., which removes another small amount of light gasoline fractions. Pumped from this still by a 5 x 7 x 10 National hot oil pump, the oil enters the second shell still which is the first in the series of large ones. The temperature of the oil is brought up to 460°F., removing more of the gasoline, whose vapors enter a bubble tower with the vapors of the gasoline from the first shell-tube still where the cut is taken overhead, while the heavier ends knocked back are returned to the second still.

The partially stripped oil



Flow Chart of Shell Still Battery

flows by gravity to the fifth still where the temperature is raised to 565°F., removing all the remaining gasoline. The vapors leaving this still enter a tower which is a duplicate of the first one, being 42 inches in diameter by 32 feet high, containing 10 bubble trays, the heavier ends backtrapping to the still. The vapors from the first tower and from the one serving the fifth still are condensed in tubular coolers placed one on each side of the receiving house. The stream of vapors may be split, a part of them entering the tubular condensers and a part of them entering and being condensed in the auxiliary condensers placed in a box nearby if the water in circulation becomes too warm or the load is greater than normal.

The gasoline-free oil flows by gravity also to the third still, which is the fourth in the series. The temperature in this one is raised to 575°F., the vapors which are driven from the oil at this temperature enter a tower 48 inches in diameter by 18 feet high containing five plates. Two cuts are removed from this tower, the one overhead consisting of a distillate fraction, while the one from the base of the tower is the first gas oil cut. Condensation and cooling of these fractions are effected in the submerged coils in the condenser box placed on the roof of the receiving house.

ROAD OIL CUT

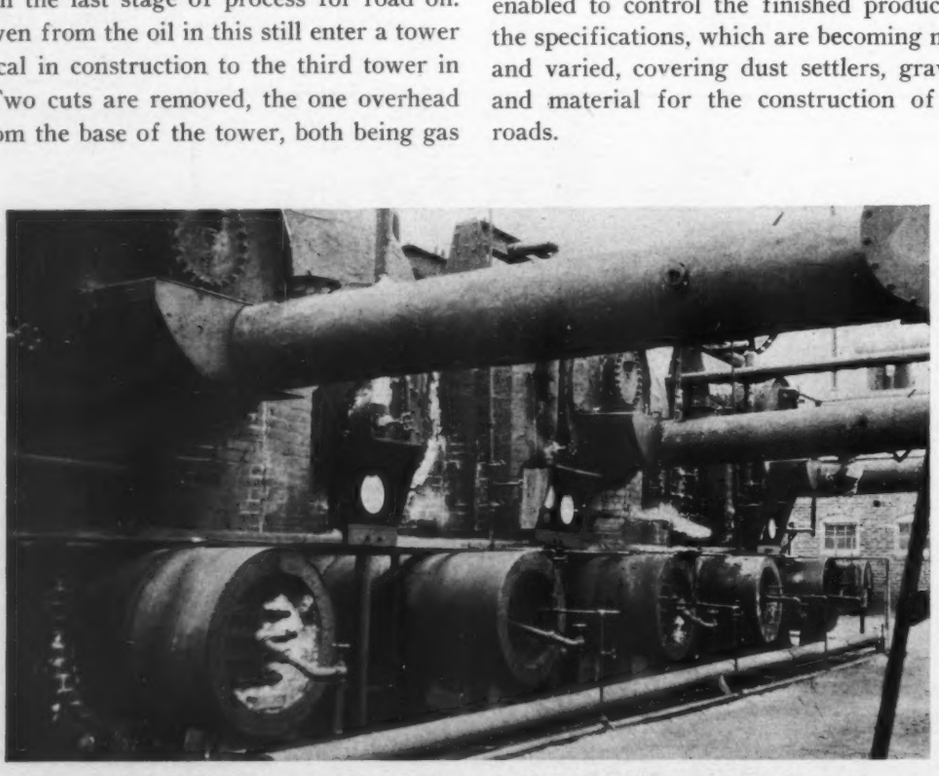
A 4 x 7 x 10 National hot oil pump removes the oil in process from this still, delivering it to the fourth still in the battery which is the fifth still in the series. The temperature of the oil is raised in this still to 680°F., removing those fractions required from the residuum, which is now in the last stage of process for road oil. The vapors driven from the oil in this still enter a tower which is identical in construction to the third tower in the process. Two cuts are removed, the one overhead and the one from the base of the tower, both being gas oil. Cooling of these cuts is effected in the same manner as that from the previous still.

Steam is used in all five of the stills to assist the evaporation of the required cuts. It is taken from a common header through individual lines which pass through the combustion chambers beneath the shells, superheating it to be distributed evenly from the bottom of the stills through perforated pipes.

The residuum from the fourth still in the battery, or fifth in the series, is reduced to specification road oil by varying the heat and the amount of steam injected into the liquid while it is in process. The bottoms pass from this still to enter the coils in the combination degasifier, dehydrator, sand settler and heat exchanger. A pump set beyond the outlet of the apparatus picks up the cooled road oil to deliver it to the proper storage.

By carrying a sufficient amount of steam, determined by tests covering the nine years spent in making this product, the ductility of the oil is increased by the addition of steam, and, without it, the residuum is cracked to a certain degree, causing the oil when cooled to be of a brittle nature.

The addition to the plant facilities of a 3000-barrel skimming plant, erected by Southwestern Engineering Corporation, provides equipment that will assist materially in the manufacture of this product. The plans of R. M. Johnson, refinery superintendent, are to process the raw crude in the compact skimming plant, down to the last two gas oil cuts, then to run the residuum from the bottom of the main fractionating tower, to finish the road oil in the shell still battery. By doing this, he will minimize the tendency of the oil to crack, and be better enabled to control the finished product to conform to the specifications, which are becoming more complicated and varied, covering dust settlers, gravel matt binders and material for the construction of oiled macadam roads.



Front of Shell Stills Showing Dutch Ovens and Method of Removing Gasses from Combustion Through the Shell-Tube Stills

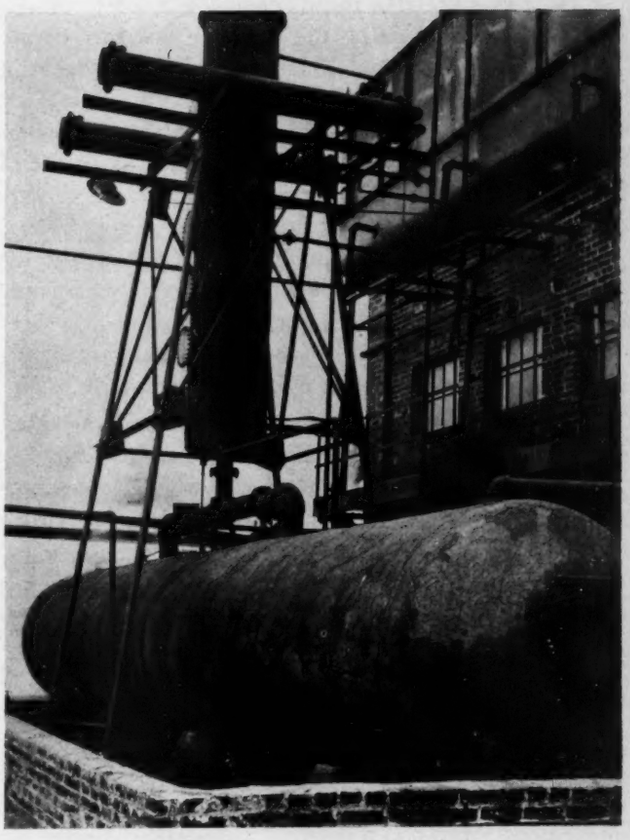
Heat Exchanger Used in Sediment Removal

OIL from both the deep and shallow wells in the old Allen pool adjacent to the town of Allen, Oklahoma, carries small amounts of salt water and fine sand which are quite difficult to remove. Some of it settles out in the lead line tank batteries on the various leases, but enough is carried in suspension, coming in with the oil at Sunray Oil Company's refinery that some method of separating it must be provided before the charging stock enters the stills.

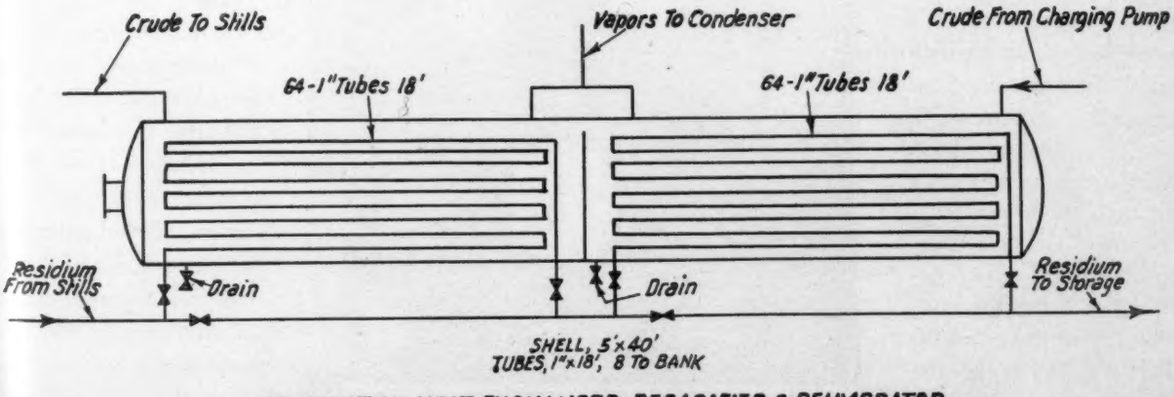
R. M. Johnson, superintendent of the refinery, has installed a simple piece of equipment that acts as a heat exchanger, dehydrator, degasifier and sand settler. Making use of a shell with convex ends, five feet in diameter by 40 feet in length, he placed it behind the receiving house on the residuum line from the last shell still, the bottoms from which have been reduced to a 19 gravity road oil. Setting the tank in a horizontal position on concrete piers, he placed a baffle plate inside it midway between the ends, bringing it up close to the top, but allowing enough space that the charging stock being processed could pass from one compartment to the other as it is being pumped through to the stills. In each compartment there is placed a heating coil, consisting of 64 one-inch ordinary pipe tubes 18 feet in length. These are arranged in eight banks, eight runs high, taking off from a three-inch header, converging in another header before passing to the other compartment containing the second coil.

The residuum flows by gravity from the last still to

(*Continued on page* 104)



Sand and Salt Water Setting Apparatus As Used by Sunray Oil Company at Allen, Oklahoma



COMBINATION HEAT EXCHANGER, DEGASIFIER & DEHYDRATOR

Flexible Continuous Acid Treating System

DISCARDING the old batch agitators formerly used in treating the pressure distillate derived from the two Jenkins cracking units operating on a gas oil charge, Eason Oil Company has installed a continuous closed circuit acid treating plant for this material in the refinery at Enid, Oklahoma. With the old units, the company had experienced some losses of gasoline attributed to treating and blowing the gasoline in these agitators at atmospheric pressure. With the new equipment, the gasoline, under approximately 25 pounds pressure at all times, does not come in contact with the atmosphere at any point between the cracking plant run-down tanks and the rerun battery of shell stills.

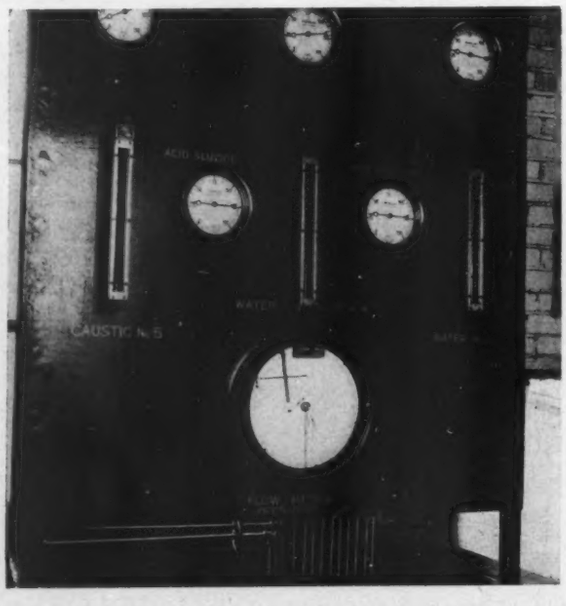
All the equipment was purchased new and especially for this plant excepting the raw acid and caustic solution storage tanks. These were converted from surplus material on hand in the material yard. The treating plant so far as contacting is concerned, consists of five, five by 40-foot welded steel tanks with their complements of columns and piping. Connections are made through which the material in process flows through all of the battery before entering the finished storage. It is compact and is located convenient to the cracking units and the rerun stills. The first batch was processed in June, 1930, and has operated continuously since that time with practically no replacement of piping or equipment.

TREATING CIRCUIT

The pump room, a permanent brick structure covered with Johns-Manville transite roofing, contains all the pumps necessary with which circulation is maintained on the pressure distillate, acid, spent acid, caustic and water. The first pump, a three-inch Westco turbine driven by a 10 horsepower General Electric motor, picks up the pressure distillate from the run-down battery at the cracking units. It is driven to the first contact column in what the operator calls the "water shot" contact, being intimately mixed in a six-inch riser, containing two Duriron mixing nozzles, with the partially-spent acid from the second tank.

The acid and pressure distillate leaving the contact column travel together to the rear of the first tank to enter through a connection placed in the shell at that end. Being fed at the rate of 5500 gallons per hour, the pressure distillate has ample time to be separated from the acid before it is taken from the forward end of the tank through a connection placed in the top of the shell. The precipitated sludge is removed from the tank through a connection in the under side of the shell at the front end, to be trapped in a small tank placed immediately beneath the large settling tank.

The level of the sludge is watched closely through a series of test gates placed closely together, all five of which enter through connections to a common header forming a sampler. As this sludge is drawn from the large tank, it is blown to a receiving tank near the Winkler-Koch fuel oil cracking furnace where it is burned. No large amount of it is available but it is burned rather than to permit it to flow to earthen storage where during heavy rains it could cause damage by being distributed over the surrounding country.

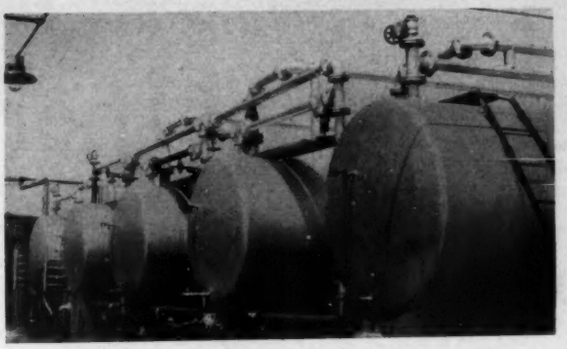


Control board in Eason Oil Company's Pressure Distillate treating plant, Enid, Oklahoma

As the partially-treated pressure distillate is removed from the upper side of the shell under process pressure, it is discharged to the second contact column by a Hills McCanna proportioning acid pump to be mixed with the raw acid delivered to a riser containing two Duriron mixing nozzles. The pump is operated by a one horsepower General Electric motor through a Boston speed reducer. The reduction in this gear box is 40 to 1, allowing the acid pump to handle 1 1/16 barrels of acid per hour on a 1½-inch stroke. Both the acid and pressure distillate travel in the same

manner to the rear of the second tank as in the first contact operation.

Test cocks are placed in the second tank in the same manner as in the first tank. Acid, as it accumulates is permitted to drain from it to a small tank placed under the tank as in the first, but this acid is picked up by a Westco turbine to be delivered to the "water shot" column in the first contact.



Treating tanks in Eason Oil Company's P.D. acid process plant.

WATER WASH

The double treated pressure distillate is removed from the second tank in the same manner as from the first, to be treated in a contact column having three Duriron mixing nozzles, with water delivered by a three-inch Westco turbine handling 2400 gallons per hour. After being in contact in this riser, the water and pressure distillate travel in the same manner to the third tank as in the previous operations.

Entering the tank through the connection in the top of the shell, the water is separated by gravity from the pressure distillate, and is drawn from the tank from a connection placed in the under side near the end in a constant stream, the size of it being determined by the washing charge, and regulated by manual control. As the treatment progresses, the operator opens a gate in the water drain line to permit a predetermined level of water to remain in the tank. It is maintained high enough inside the shell to preclude the possibility of the pressure distillate by-passing with the water and flowing to the sewer.

The washed pressure distillate flows from the third tank as in the past two cases, entering the fourth contact column having three mixing nozzles. Caustic from the storage tank is in constant circulation through this column, being delivered to it by a 1½-inch Westco turbine pump driven by a one horse power General electric motor. As the caustic with the pressure distillate flows to the rear of this tank, it falls to the bottom and leaves through a connection placed in the same position as the water drain in the third tank, but is driven under process pressure to the caustic storage tank for recycle. It is used over and over again through the contactor until it is spent. When this occurs, it is drawn from the bottom of the tank to the sewer while a fresh charge of caustic is prepared to continue treatment.

The neutralized pressure distillate travels from the fourth tank to the fifth through the last contact column having two, six-inch Duriron mixing nozzles where the caustic is washed from it by the second application of water. The water for this wash is furnished by another three-inch Westco turbine, a duplicate of the first water pump and the same size as the pressure distillate feed pump. Here the water is maintained at the rate of 2000 gallons per hour, to enter the fifth tank with the finished pressure distillate and wasting to the sewer as in the first water treatment. The pressure distillate leaves the top of the shell of this tank as it left the others, but is now treated and neutralized. The color is maintained between 21 and 22 Saybolt as it enters the storage preliminary to rerunning in the shell stills of the original skimming battery in the plant.

FLEXIBLE IN DESIGN

By-passes are placed in the line of travel of the pressure distillate so that if it is found expedient to eliminate the caustic wash after the contact with the acid; it may be placed in the fifth tank for water washing, or, through the manifold of the by-pass, it may be permitted to flow through the third tank to the fifth, or the fourth to the fifth, or eliminate the last three tanks. Again, it may be permitted to flow through all the tanks without passing through the contact columns of the last three tanks, or through all the tanks as in the original design.

On the control board are the instruments which guide the treater in his operation of the treating plant. A Foxboro flow meter recording the amount of pressure distillate handled is placed at the bottom of the board. Above it are the Morey, Jones and Lovell indicating manometer flow indicators showing the amount of water from both the pumps, and the caustic to the neutralizing contact column. Ordinarily the caustic is maintained at a rate of 1700 gallons per hour based on the charge of 5500 gallons of pressure distillate. On each side of the centrally located flow indicator are two American Schaeffer and Budenburg indicating pressure gauges showing the acid pressure and the pressure on the sludge. Above and at the top of the board are three more indicating gauges showing the feed pressure on the distillate, the water pressure, and the pressure on the caustic tank. Each instrument is marked for its purpose by having stenciled near it in white letters the name of the material indicated.

The plant is usually operated only during the daylight period, beginning at seven a. m., but continuing without intended interruption until the previous day's production of pressure distillate has been consumed. Remarkably little attention is necessary to operate this plant after it has been placed in operation, the operator having very little to do except watch the color of the finished distillate after he has once adjusted the flow of the distillate charge, acid, caustic and water through the installation.

Electrically Operated Recording Manometers

By J. H. POUND
Professor of Mechanical Engineering, Rice Institute

THOSE liquid-filled manometers which transfer the motion of the liquid to the outside of the instrument by means of magnetic or electrical effects have the advantage of avoiding stuffing boxes subject to high pressures. In addition, the electrical instruments have the ability to locate recorders or indicators at a very considerable distance from the manometer. In flow-meter service the manometer does not, of course, ever have to be very close to its orifice or similar source of differential pressure; but as long pipes connecting orifice and manometer increase the likelihood of trouble developing from leakage or pipe stoppage, the maximum allowable length of such pipes is certainly much less than the limit on electric wiring.

One of the earlier instruments using magnetism in its construction carried the motion of a float resting on one mercury surface up through a rack and pinion to a horizontal rotating shaft terminating in a horse-shoe permanent magnet. The poles of this magnet were set very close to a flat vertical plat of non-magnetic metal forming the back of the case containing the recorder or indicator mechanism. On the atmospheric pressure side of this plate was a horizontal shaft carrying a similar magnet, held by magnetic attraction in a position opposite that of the magnet rotated by the float and rack. The movement of the shaft in the recorder case operated the pen, indicator pointer, and integrator mechanism. This design had a serious disadvantage in that when used with fluids under heavy pressure, the thickness of the non-magnetic partition became considerable; and for high pressure service especially, other designs are favored today.

Another type of manometer using magnetism but built only in the indicating form uses a stainless steel ball floating on mercury inside a tube of non-magnetic material, with the manometer designed to cause most of the rise and fall of the mercury to occur inside this tube. (Figure 1.) The tube itself is placed between the legs of a horseshoe magnet pivoted on knife edges so the magnet follows the motion of the ball. A light weight pointer attached to the magnet indicates flow quantities on a scale formed in the quadrant of a circle. The use of a small-diameter tube instead of a flat plate of course allows relatively thin walls to be provided, even when a heavy internal pressure must be carried. When this indicator is designed for steam flow measurement, it is often mounted beside similarly shaped draft gages on a compact boiler control panel.

But the use of magnetism alone is not common in modern manometers. While it is true that all the electric flow meters manufactured today actually use magnetism freely in their operation, none of them depend entirely on the forces developed by permanent magnets. The substitution of the electro magnet requires the provision of a reliable supply of electric current, but in return it allows great free-

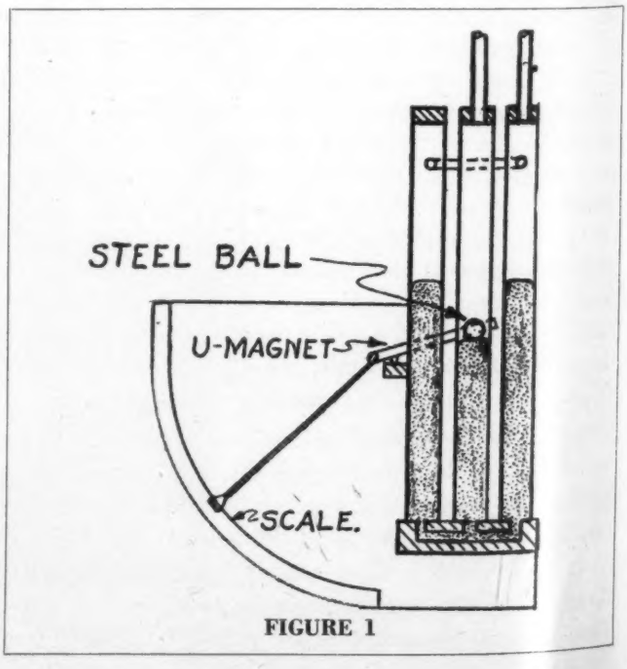


FIGURE 1

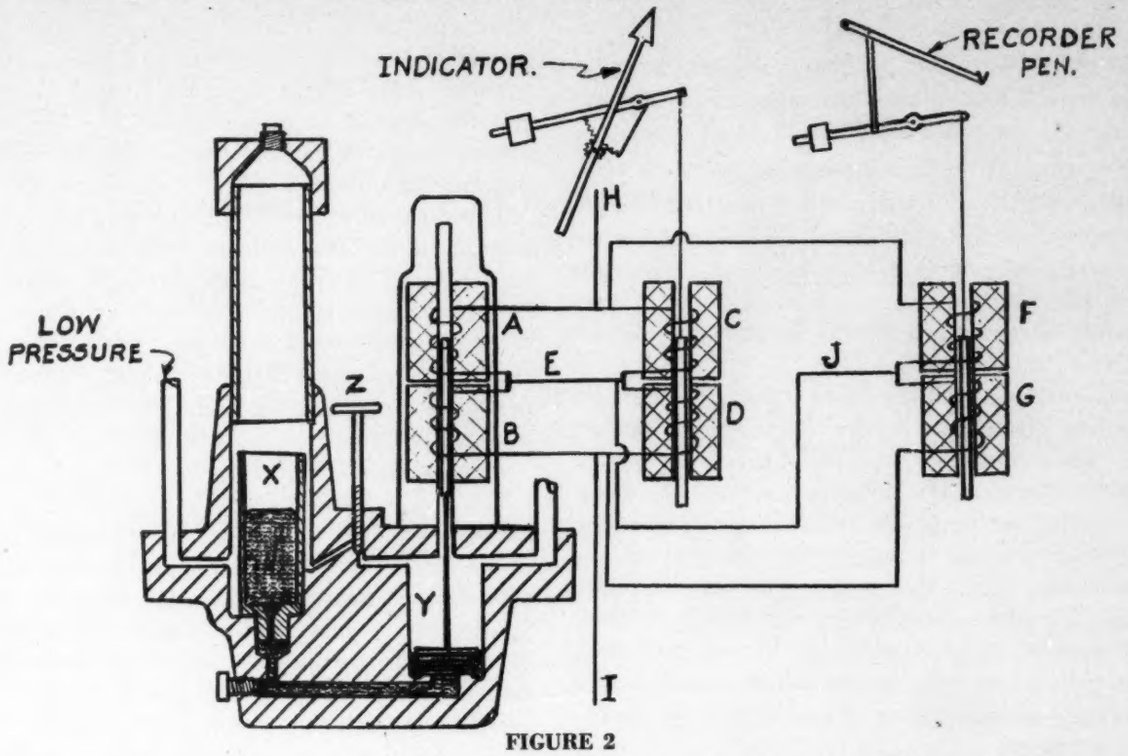


FIGURE 2

dom in the location and design of recorders and similar instruments.

One type employing magnetism in a unique manner contains an electric circuit known as the induction bridge. The manometer itself (Figure 2) is essentially a mercury-filled steel **U** tube with uniform diameter legs. The high pressure leg contains a large-diameter float supporting a vertical rod of non-magnetic material terminating in a cylinder of soft iron. Both rod and cylinder are guided to move easily in a vertical non-magnetic alloy tube strong enough to withstand a very heavy internal pressure. Surrounding this tube is a water-proof divided coil AB of insulated wire with three leads brought out of the casing as shown. All the electric equipment is subject to atmospheric pressure only. Loss of mercury from excessive pressure-differential is prevented by a valve disc hung from the bottom of the float and seating on the bottom of the cistern while the latter still contains mercury. By changing the diameter of bushing X, the range of the instrument can be altered easily with almost no disturbance of the installation. In some designs of this instrument, the mercury in leg Y can be admitted to another compartment by simply opening a bypass valve built into the instrument, thus forcing more of the liquid head due to a given differential pressure to occur in the leg containing the float and allowing accurate measurement of low rates of flow. Providing this double-range valve allows easy measurement of high or low rates of flow with one meter.

The essential peculiarity of this instrument is its use of electromagnetic induction in transmitting the motion of the float to points outside the instrument. Briefly stated, the system operates in this manner: Alternating current enters the circuit at point H and leaves at point I. The amount of current is relatively unimportant, for it automatically divides itself in the various branches AB, CD, and FG in amounts depending on the electrical characteristics of these branches; and the percentage carried by each branch will always be the same irrespective of the total current drawn from the supply circuit. If all the armatures are midway between the ends of these vertical coils, no current will flow in the wires E and J, and all pens and indicator pointers should show zero flow. But as the differential pressure forces the iron armature down into coil B, the increase in the magnetic field passing through B increases the opposition of this coil to the flow of alternating current and deflects part of this current along E and J to coils D and G, thus strengthening the electromagnetic field around these coils. The pull of these strengthened fields drags their iron armatures down into the coils, against the resistance of their counterbalances. But the penetration of the iron into the lower coils has the same effect on D and G that it had on B—that is, the development of an opposition to the flow of current, thus forcing back to B its proper share and quickly restoring to each pair of coils its original proportion of the total current supplied from the line. When this equilibrium develops, no current flows in E or in J and all armatures are held in definite positions determined only by the position of the manometer float. Zero adjustment of the manometer is secured by opening the equaliz-

ing valve Z and shifting the coils A and B vertically by an adjusting screw with lock-nut.

If the zero position of pens and pointers are correct, fluctuations in voltage or frequency of the electrical supply can cause no error in the instruments, for the motions of the armatures always restore their original proportions to the parts of the circuit. For the same reason, the addition of a number of instruments to the circuit shown in Figure 2 is possible without affecting its accuracy, and the use of very long wires between any of the instruments is also allowable.

The recorders and integrators used with this system utilize electrically-driven (synchonous motor) clocks. Such clocks are usually optional equipment with the mechanical manometers also, but are sometimes opposed on the ground that when the electrical supply is interrupted the charts and integrators also stop working. With the manometer just described and with all others depending on a supply of alternating current, this objection to the electric clock applies with equal force to the whole device, which will produce no indications of any sort if the electric supply is cut off.

As the recorder and indicator actually reproduce differential pressure changes and as the flow is proportional to the square root of the differential pressure, the charts and indicator scales reading flow quantities are necessarily non-uniform in graduation.

The integrator, which in this design is a mechanical device built into the recorder case, accounts for this difference between differential pressure and flow units with the aid of a mechanism containing a cam, escapement, and tripper arranged to operate a stroke-counter. This device is driven by the chart motor, and the degree of its action on the counter is of course regulated by the position of the armature in the divided inductance-coil of the recorder.

The escapement varies the time of engagement of driving motor and counter mechanism without using any sort of friction drive. This integrator also has the peculiarity of operating a special pen which makes a short radial mark on the rim of the record chart whenever the counter reading changes, thus providing a permanent record of total flow on the same chart which shows the variation in flow.

A very different type of electric meter sends out to electro magnets at each instrument a variable current which is controlled by electrical resistance at the manometer. Figure 3 shows the peculiarities of this design, though the sketch (like all the other figures does not pretend to show correct mechanical details or proportions. A supply of alternating current of the usual characteristics is brought into the mercury inside the manometer. To escape, this current must first pass into the vertical rods dipping into the mercury and then out through the resistances placed in series between the rods not in contact with the mercury; hence any rise in the mercury level will gradually short resistance out of the circuit and thereby increase the current flowing in it. A reduction of the flow at the orifice has the opposite effects.

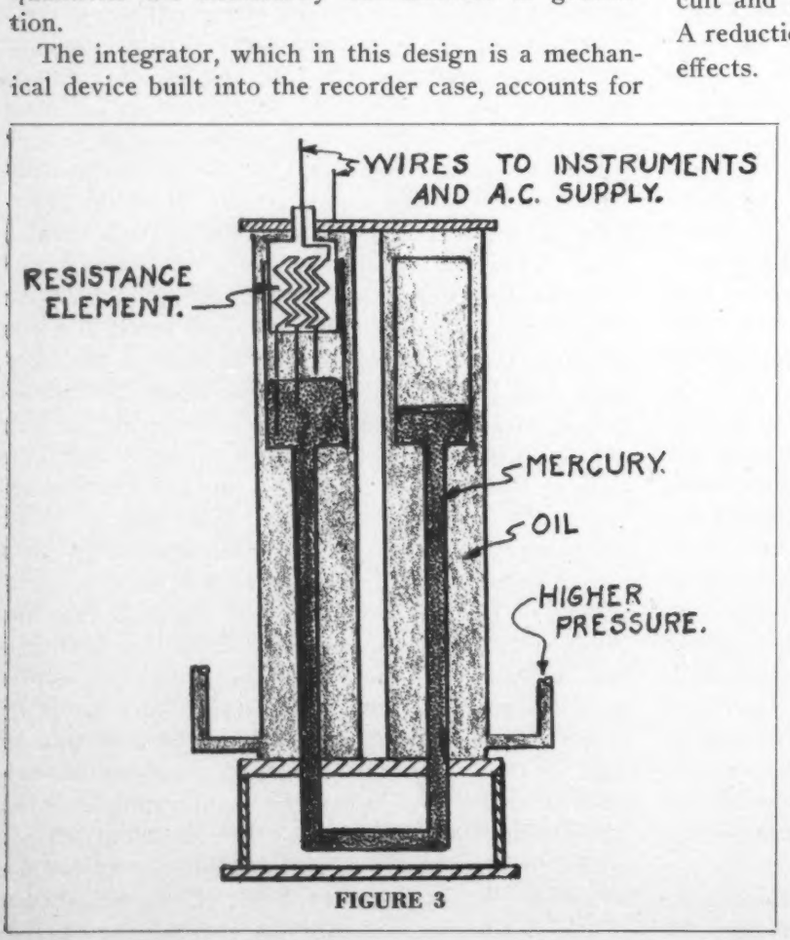


FIGURE 3

DETAILS OF OPERATION

In practice, the maker of this type of meter provides a large number of rods (perhaps 91) of nickel or stainless steel, each of different length, arranged for compactness in concentric coils or in a spiral. The steps represented by this number of rods would be distributed over a radial distance of about 3½ inches on a 10-inch diameter chart. In flow meters, the resistance separating each rod is so adjusted that the current passed is proportional to the actual rate of flow of the fluid being measured rather than proportional to the difference in pressure shown by the U tube; thus the scales of indicator and recorder have uniform graduations.

As the bundle of rods and resistances can be easily moved vertically in the manometer by a screw thread, exact adjustment of mercury quantity in the meter is not essential. The instrument should, however, be set plumb. A built-in equalizing valve allows easy zero adjustment of the instrument, and a disc check-valve floating on the mercury in the leg not containing the resistance elements prevents blowing out of

the mercury. The addition of resistance to an existing manometer-body provides an easy method of changing the scale of the meter to suit different orifices or similar changed conditions.

Any conducting material, such as pipe scale, floating on top of the mercury would of course offer the possibility of short-circuiting resistance which ought to stay in the electric circuit. To minimize this risk, pressure connections are brought into the bottom of the manometer chambers, thus trapping such sediment outside the mercury wells. In steam or water meters, a layer of transformer oil is provided to separate the mercury from the water filling the pipes leading to the orifice plate.

With this type of manometer, a separate instrument performs the functions of recording, indicating, and integrating. Each instrument has its zero setting independent of the others, and damage to one instrument does not prevent the others from acting.

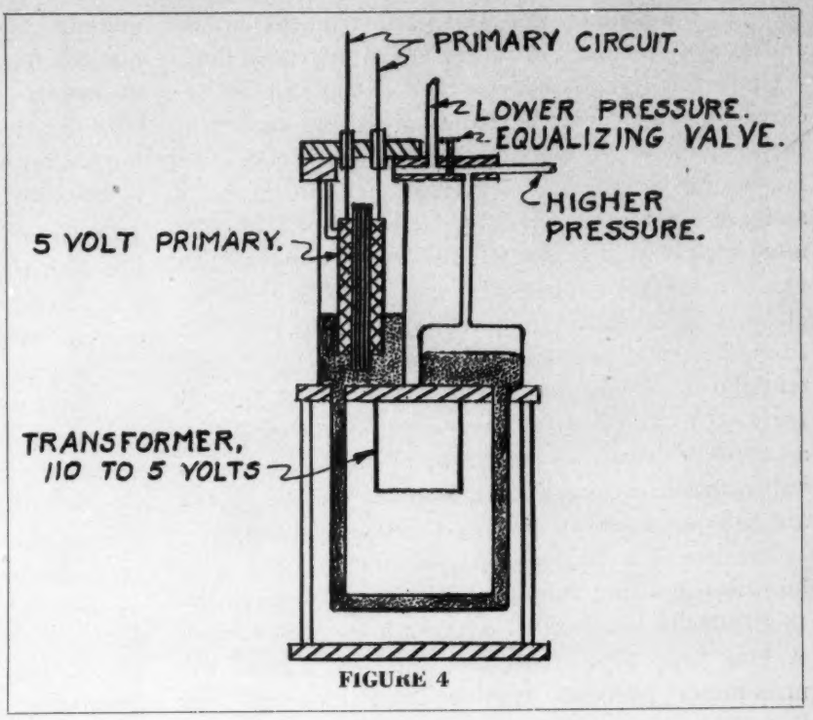


FIGURE 4

The position of the recorder pen depends on the relative strength of two solenoids (electro-magnets) which pull on a laminated core connected to the pen arm. As the mercury rises about the rods in the resistance element the current sent through this upper solenoid rises, and magnetism pulls the laminated core and pen toward the position for maximum reading. The lower solenoid is in a potential circuit taken from a transformer in parallel with the meter circuit. Its field tends to pull the core toward the zero reading position. As the core moves in and out of these two solenoids, their magnetic fields vary. Eventually their opposing pulls balance exactly with the core (and pen) in a definite position. These recorders are built to use either round or strip charts.

In the indicator, the moving element includes a pointer mounted on a vertical spiral-shaped disc which is pivoted to swing under the pull of two electro-magnets. The potential-circuit magnet pulls the disc toward its zero position just as in the case of the recorder, its force being proportional to the area of disc between its two pole pieces. The magnet receiving the current from the resistance element at the manometer pulls the disc toward its maximum reading with a force depending on the current flowing through this circuit. The rotation of the disc eventually brings these forces to a balance with the pointer at a definite place on its circular scale.

The integrator contains no clock mechanism of any sort but operates on the principle of the watt-hour meter compensated for voltage variation, with electro magnets instead of fixed magnets. One coil carries current from the manometer circuit, another carries current from the potential circuit mentioned above. The speed of rotation of the meter disc depends on the conductance of the manometer circuit; so the readings of the totalizer, like those of the indicator and recorder, are not affected by variation in the voltage of frequency of the electrical supply. Electricity consumed by the whole system per 24 hours is a negligible amount.

Another make of flow meter uses electrically operated recorders, indicators, and integrators of the admittance-meter type but varies the current per volt in the instrument-circuit by a transformer action controlled by the level of the mercury in the manometer. The smaller diameter (low pressure) manometer leg, in which most of the change in mercury-level occurs, contains a primary coil (Figure 4). This coil is supplied with low voltage (usually five volts) alternating current taken from the secondary of a small external step-down transformer which is in turn connected to an ordinary 110 volt supply. This primary low-voltage manometer coil is wired in series with the recorder, indicator, and integrator.

If a ring of mercury surrounds the lower part of the primary coil, this mercury becomes the equivalent of a single-coil secondary circuit in a transformer, and an induced alternating current will circulate through the mercury. The energy for this eddy current must come from the primary circuit. An increased depth of mercury will decrease the resistance of this secondary mercury circuit and increase its current, thereby increasing the current passing

through the primary coil and its instrument circuit and causing a record or indication of increased flow.

Uniformly graduated recorder charts can be secured by using correctly shaped displacers located in the manometer leg containing the primary coil. The indicators, however, do not require uniform scales and are most often graduated non-uniformly. The integrator is in principle a totalizing wattmeter, with magnetism from a potential coil connected to the alternating current supply taking the place of flux from the usual permanent magnet. The use of potential connections in association with the current (primary) circuits makes this integrator and all the admittance meters unaffected by ordinary changes in voltage and frequency. Synchronous electric clocks are recommended for driving the recorder charts.

The use of a welded steel manometer body with built-in equalizing valve and no moving parts allows this meter to be operated with high static pressures. A long drop pipe connecting the two legs of the manometer prevents trouble from blowing over mercury at overloads. If the insulation of the primary coil should fail where the coil is surrounded by water, a ground will be prevented by the smallness of the voltage in the primary. Materials floating on the mercury surface have very small chance to interfere with the operation of the meter.

In general, the electrically operated systems for use with mercury manometers have these characteristics: all of them require a supply of alternating current whose failure puts the whole system out of service; the integrators, recorders, and integrators are most often separate instruments which can be located independent of each other and whose separate failure does not put the others out of commission; any of these separate instruments can be located far from the manometer; very high static pressures may be used without any adverse effect on the accuracy or reliability of the system. The advantages in this list have resulted in a widespread use of these instruments in industrial and in power generating plants.

Sources and Manufacture of Solid Carbon Dioxide

(*Continued from page* 78)

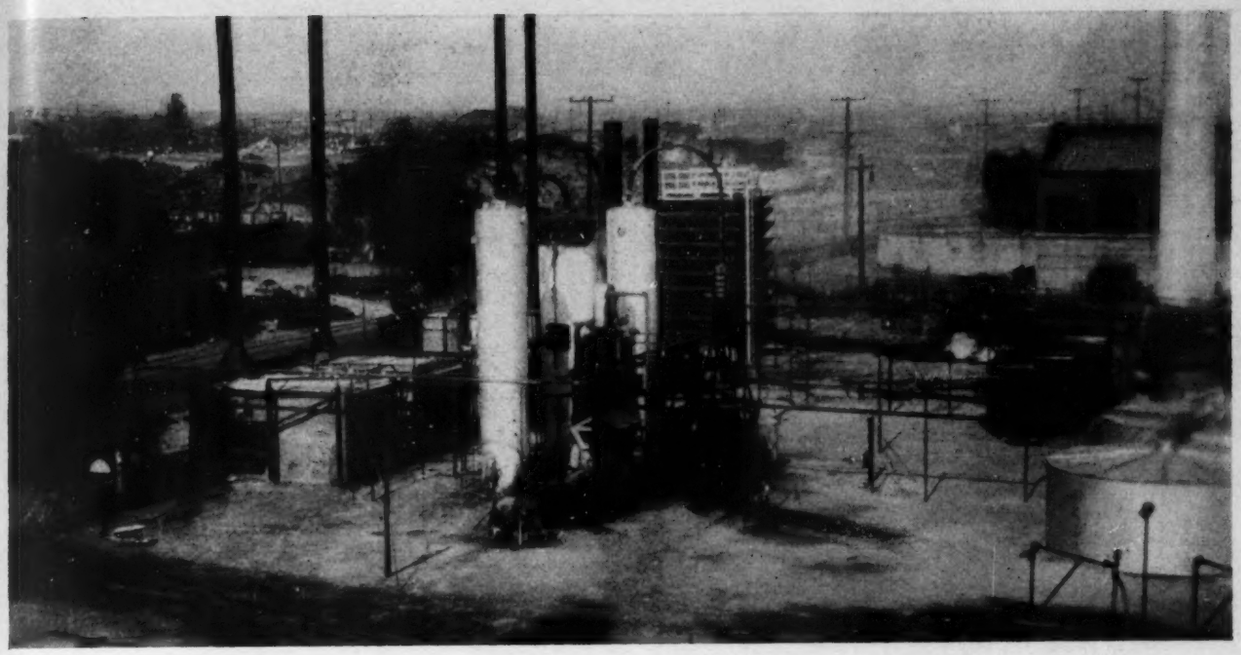
connected to the filling stand—used for loading liquid carbon dioxide.

For the preparation of solid carbon dioxide, the product under 900 pounds pressure or higher—about 1100 pounds—is released into vertical snow chambers and then compressed into blocks 10 inches square. The 10-inch cube is the most popular marketed size, although some snow machines make 20-inch long blocks of Dry-Ice, which are later sawed in two and packed for shipping.

The original snow tanks have been superseded in The Dry Ice Corporation plants by the newer vertical inclosed presses, serving both for deposition of solid CO_2 directly in the press chamber and also for pressing the blocks to size. These are constructed with cast steel chamber tested to 375 pounds per square inch and produce blocks 20 by 20 by 10 inches which are sawed to 10-inch cubes. Inside of the chambers there is usually a square piston or ram, worked by a hydraulic cylinder below the floor level and a similar hydraulic cylinder controls the head of cover of the chamber. With the hydraulic cylinders of ample size, a simple centrifugal pump provides the necessary water pressure.

The solidification phase of the solid carbon dioxide manufacturing processes is simply one of compression, with proper intercooling, purification, storage, cooling, expansion, and recompression of the "snow" into the solid block weighing around 40 to 50 pounds. The processes throughout each step, from absorption of the carbon dioxide from its source material, whether it is furnace gases or other material, to concentration of the extracted gas, then liquefaction by compression and subsequent solidification by expansion, and compression of the snow, are all steps or processes with which the refinery and natural gasoline engineer is more or less familiar. The development of successful processes which will be commercially practical when operating on furnace gases capable of yielding 10 to 15 per cent, perhaps, of carbon dioxide will see much more interest aroused among refiners in this new refrigerating industry.

References—
Reich, Chem. & Met. Vol. 38, No. 5, May, 1931, p. 270.
Reich, Chem. & Met. Vol. 38, No. 3, Mar., 1931, p. 136.
Jones, Chem. & Met. Vol. 37, pages 416-7, 1930.
Jones, Chem. & Met. Vol. 29, pages 103-5, 1923.
Quinn, J. Chem. Education, Vol. 7.
Minor, Ind. Eng. Chem. page 291, 1928.
Martin, Ind. Eng. Chem., page 256, 1931.
Allen, Chem. & Met. Vol. 32, page 677, 1925.
Woodruff, Ind. Eng. Chem. Vol. 19, page 1147, 1927.



Skimming and Vapor Phase Cracking

By NEIL F. BLAINE
Vice-President, Vulcan Refining Company, Limited

IN the accompanying article, Niel F. Blaine, vice-president, Vulcan Refining Company, Ltd., (subsidiary of Vernon Oil Refining Company), describes the new combination skimming and vapor phase cracking system recently placed in operation at the company's Vernon, California plant. Mr. Blaine is the designer of this process and states that patent application has been filed covering its use. The writer will be remembered as the author of "Nacogdoches Refinery Uses Combination Process," which appeared in this magazine in the issue of July, 1930, Page 73.

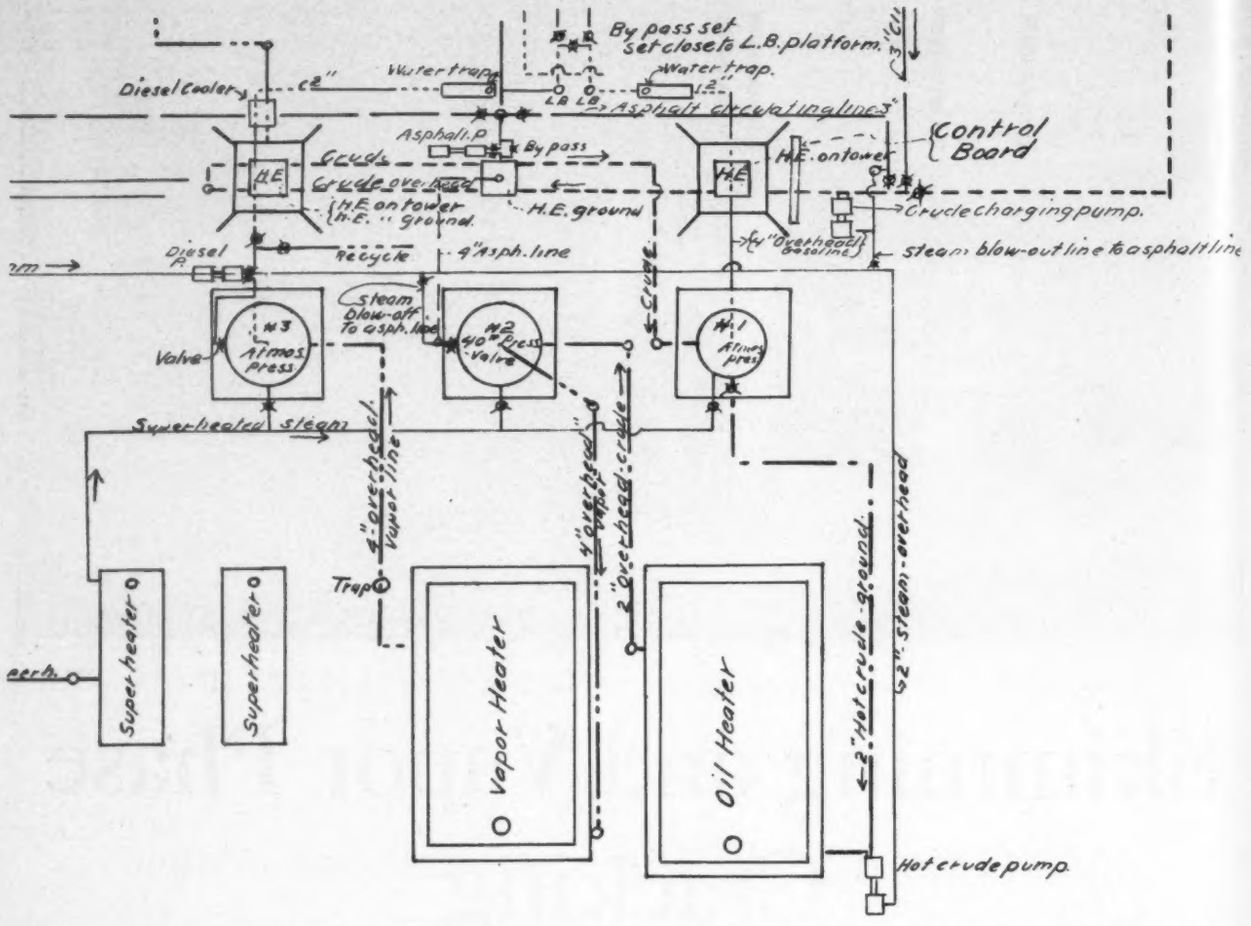
ON March 1, Vernon Oil Refining Company decided to increase its refining capacity by the addition of new refining equipment. In considering the proper type of refinery, the directors considered available crude as well as the company's own crude and considered the marketing possibilities of different products, both local and export, and concluded that the most satisfactory type of unit possible to install was one which would permit of great flexibility so as to be able to meet fluctuating marketing conditions and one which would operate with the maximum of efficiency at minimum cost and also permit of being installed in a limited available ground space.

Vernon Oil Refining Company formed a subsidiary company called Vulcan Refining Company, Limited, at the same time organizing an engineering company to take over, develop and utilize certain processes for refining which they thought contained merit.

The new refinery is located next to a refinery operated by Vernon Oil Refining Company since 1916. It is located in the Vernon district on the outskirts of the city of Los Angeles and has a capacity of 1500 barrels of crude oil per day. In construction, the location was of material advantage, because it facilitated delivery of pipe and other materials.

The accompanying sketch shows the location of the unit proper, as well as the location of auxiliary equipment, such as run down tanks, finished storage tanks, transfer pumps, crude unloading and natural gasoline unloading racks and truck loading racks.

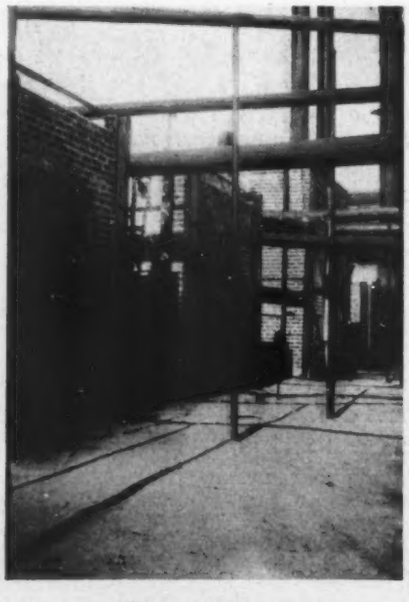
Consideration was given in the general plant layout to the proper spacing of apparatus to prevent, as well as possible, any fire hazard. Generally, the foam pumps



in use in connection with the old refinery have been tied into the lines of the new refinery, giving protection to each storage tank, to all loading racks and hydrant connections around the distilling unit itself.

The lighting system installed has been given much thought in view of what was experienced elsewhere and incorporates daylight bulbs. These bulbs are capable of diffusing their light through holophane glass and do not glare. The water used throughout the plant for cooling and general purposes contains about ten grains of hardness, and consequently, is put through a softening apparatus before using it as boiler feed water.

The distilling and fractionating unit is the result of years of development along vapor phase cracking lines. Through preheat obtained by heat exchange, we take off the normal gasoline present in the crude oil and then pass the denuded crude through a heater where the oil is brought to sufficient temperature to flash down to road oil or any desired bottom. The rest of the product is now gas oil, Diesel oil, lube distillate and other intermediate products in vapor phase and is cracked so that the aggregate products taken off the distilling unit are straight run gasoline, cracked gasoline, Diesel oil and road oil. The details of the flow are as follows:



Heating Battery

PROCESS DETAILS

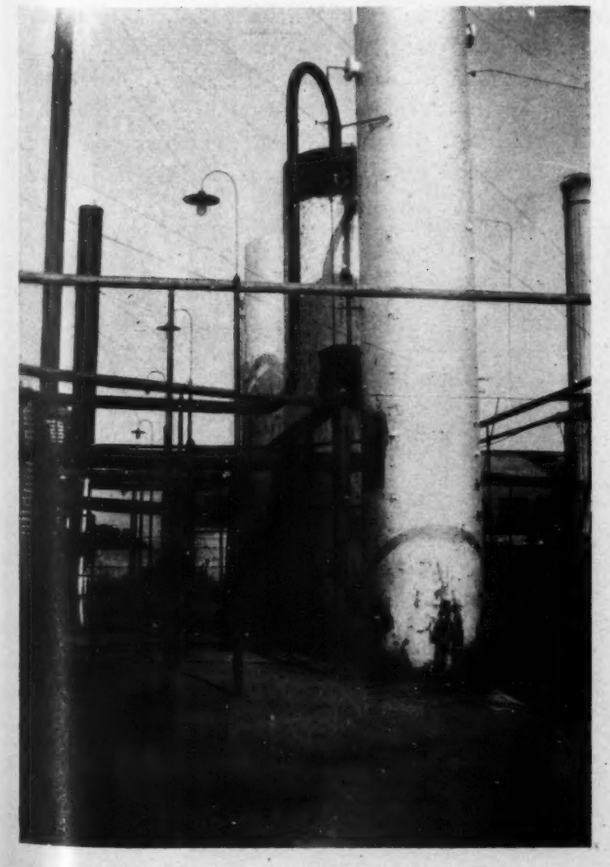
Oil is picked up by means of a crude pump from storage, is passed through a meter to a heat exchanger, exchanging heat with the off-coming stock of straight run gasoline. The crude travels from the gasoline heat exchanger to a Diesel heat exchanger, exchanging heat with the off-coming Diesel oil, from there to an asphalt heat exchanger, and from the asphalt exchanger at a final temperature of approximately 500°F. the crude oil enters a bubble tower where the normal gasoline comes off overhead and gives up its heat to the incoming crude through the first mentioned heat exchanger, thence through a look box and then to run down tanks.

The denuded crude is taken off the bottom of the tower by means of a hot oil pump at a temperature of approximately 420°F. and then

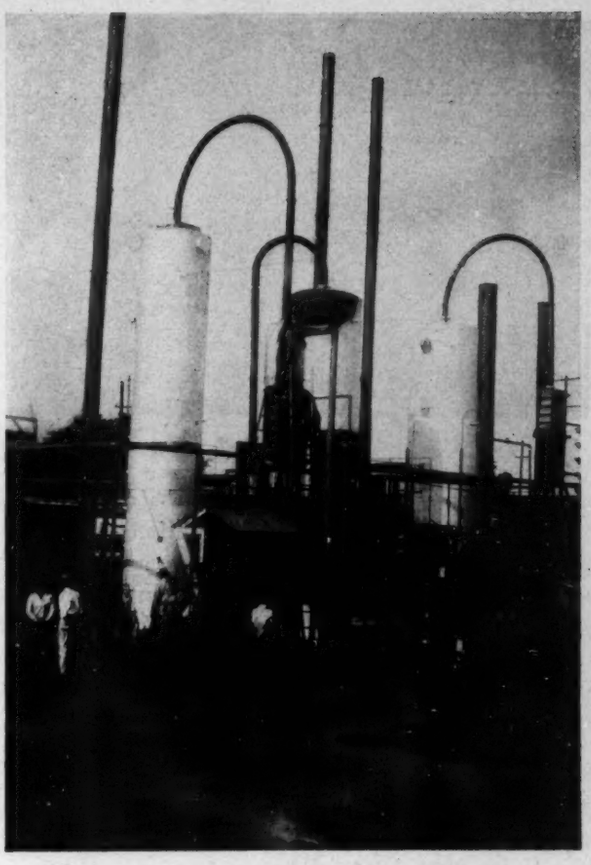
pumped into the crude heater. The oil leaves the crude heater at a temperature of approximately 770°F. and enters the second bubble tower. From the bottom of the bubble tower, the asphalt is drawn off and passed through a heat exchanger and thence out to storage. From the top of this bubble tower, the vapors pass into a vapor heater at approximately 40-pound pressure. The vapors are heated to a final temperature of 950°F. to 1050F°., depending on the nature of the charging stock. They then travel to a final fractionating tower, where the cracked gasoline is taken off overhead and the Diesel oil is taken off the bottom. The Diesel oil can either be recycled for a further cracking or passed out to storage. Final cooling of gasoline streams is obtained by circulating water through a closed type of condenser.

CONTROL OF SPECIFICATIONS

A portion of the gasoline taken off overhead, both straight run and cracked, is used to reflux the bubble towers, and penetration of the road oil taken off the bottom of the second bubble tower is controlled by the use of 1200° F. steam. This steam is also used in the bottom of the other two bubble towers to strip all of the gasoline out of the tower bottoms. It has been found with a reflux ratio on the straight run gasoline of approximately one to one and a reflux ratio of one and one-half to one in the cracked gasoline, a fractionating cotangent as high as .37 to .42 can be obtained with ease.



Hook-Up of Stills and Fractionating Columns

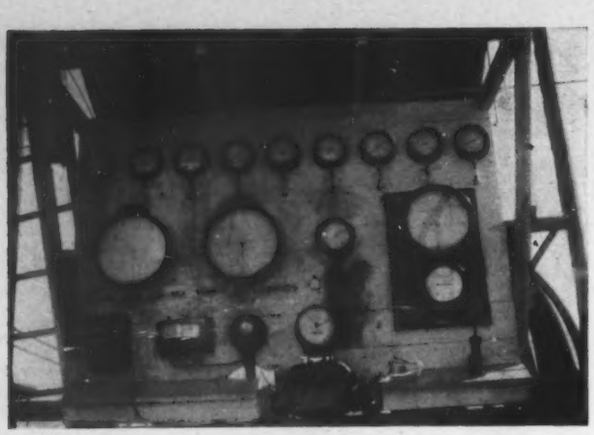


Fractionating Towers and Heat Exchangers

The crude heater is made up as follows: 60 per cent convection tubes and 40 per cent radiant tubes, the convection tubes being in two banks, separated by an arch, and the radiant tubes being on the roof and floor of the furnace proper. The tubes are connected by means of return bends, fabricated by Midwest Pipe and Supply Company. The vapor heater is designed along similar lines, the exceptions being no floor tubes, and instead of return bends connecting the tubes together, junction boxes are used, permitting cleaning the tubes in the event of coking.

Apparatus used in the plant in addition to the crude heater and vapor heater just mentioned is Foster Wheeler Corporation's steam superheater, oil heaters, H. R. T. Boiler, Armstrong and Trerice steam traps. Engineering Company oil burners are used in the crude heater and Leahy oil burners in the vapor heater. Natural gas burners are used in the superheaters to burn the plant's fixed gas, and Southwestern fractionating towers, exchangers and condensers, Union centrifugal pumps, Deming-Mueller centrifugal pumps, American Marsh simplex hot oil pumps and Worthington duplex crude charging pumps also are used.

The control instruments used are Republic steam flow meter and recorder, Republic pyrometers, Tagliabue recorder controllers for gasoline and point control, National oil meters for crude oil to the plant and conventional pressure gauges. The loading rack for trucks contains a three-inch Bassler liquid meter with air elimi-



Control Panel

nator and strainer for gasoline. Trucks can be loaded at the rate of 200 to 300 gallons per minute.

From a standpoint of fuel consumption and heat balance, the 60 days of operation of this plant so far shows a great economy in operation, inasmuch as only one heat is necessary to do the work of making the finished products above mentioned, whereas, years ago each product would be handled, reheated and refined separately.

The table of yields is as follows:

Santa Fe Springs Crude—32 gravity:

	Per Cent
Gasoline (straight run)	32
Gasoline (cracked)	20
Diesel	25
Residue	18
Fuel consumption and loss	5

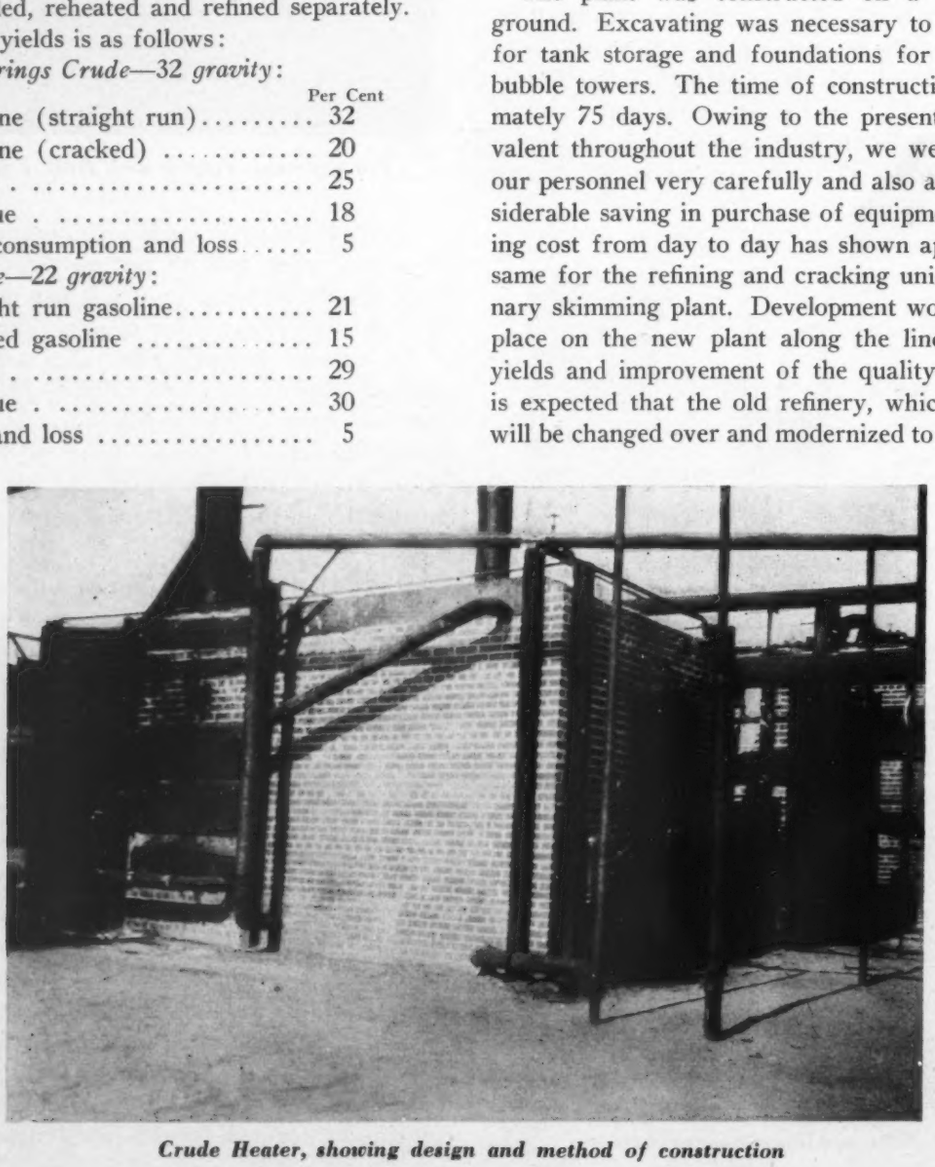
Venice Crude—22 gravity:

Straight run gasoline	21
Cracked gasoline	15
Diesel	29
Residue	30
Fuel and loss	5

The end point on the straight run and cracked gasoline are both controlled at 420° to 425° F. The Diesel oil has a gravity of approximately 30, a flash of 235 and a fire of 290. Santa Fe Springs has been run down to a 15 gravity bottom with a flash of 450 and a fire of 525. Venice crude has been run down to a road oil containing approximately 80 to 90 per cent of 80 penetration asphalt. The straight run gasoline from Santa Fe Springs crude is notoriously low in knock rating, but we have found that our cracked gasoline manufactured from the same crude will have a high octane value, and on Venice crude, our straight run gasoline and cracked gasoline blend will also have a high octane value.

In conclusion, I would say that the plant has shown its flexibility inasmuch as we have made runs on 32 gravity Santa Fe Springs crude, 22 gravity Venice crude, 30 gravity Diesel oil and 16 gravity fuel oil. From all these, commercial yields of gasoline were obtained. The use of superheated steam in the towers permits of a much lighter treat to remove the sulphur compounds from the Venice crude.

The plant was constructed on a vacant piece of ground. Excavating was necessary to prepare the site for tank storage and foundations for the heaters and bubble towers. The time of construction was approximately 75 days. Owing to the present conditions prevalent throughout the industry, we were able to select our personnel very carefully and also able to effect considerable saving in purchase of equipment. The operating cost from day to day has shown approximately the same for the refining and cracking unit as for an ordinary skimming plant. Development work is still taking place on the new plant along the line of increase of yields and improvement of the quality of products. It is expected that the old refinery, which is still in use, will be changed over and modernized to the new process.



Crude Heater, showing design and method of construction

Elements of High Pressure Stabilization

PART TWO

By I. N. BEALL
Chemical Engineer

THE accompanying article is the second and final discussion of "Elements of High Pressure Stabilization" by I. N. Beall. In this article the author analyzes the conditions necessary for efficient operation of the unit from the standpoint of the equipment and the control of processing steps. As in the case of Article Number 1, *last month, Mr. Beall was requested to confine his discussion to the elements of operation, rather than scientific or highly technical discourse. The series of two articles was prepared in answer to numerous requests for engineering information dealing with the problem of high pressure stabilization in the refining and natural gasoline industry. Definite operating rules, based on much experience in design, construction and operation of such units, are given by the writer.*

THE separation of raw natural gasoline into a number of specification "cuts" is a reasonably easy problem if recovery efficiencies are disregarded. To obtain the highest product yields day in and day out without sacrifice of quality is another matter. Good equipment, highly developed operating technique, and close automatic control are essential to maximum overall efficiency. In the design of fractionating columns, the objective is to combine flexibility with rugged simplicity. Hand control of vital points is no longer considered good practice. Automatic pressure and flow controls do the job much better. Smooth column operation, to a large extent, is dependent upon the sensitivity of the control instruments.

Pressure steam is generally used to supply the heat to the reboiler. It is desirable to so regulate the amount of steam that a constant temperature is maintained on the kettle. A steam flow meter will tell the story of how the quantity varies over a period. If the flow of steam is uniform, the duty on the thermostat will be light. In case the variation in steam flow is large, the probabilities are that considerable "lagging" will occur in the kettle temperatures. The bulk of the steam should be passed into the preheater coils through a line separate from the automatic control by-pass. Usually a half-inch to three-quarter-inch line will be found of sufficient size for the instrument control valve. In large capacity columns the use of sizes up to one and one-fourth inches may be warranted. The time lag should not be over one-half minute and the temperature lag not greater than two degrees.

Plates between the feed points to the column and the kettle or reboiler serve to strip the product of high vapor pressure undesirables. Sensitive conditions of equilibrium between liquid, vapor and condensate exist; a fluctuating temperature disturbs the column operation. Steady temperature on the reboiler and steady operating pressure insure a uniform vapor pressure product. A larger tube evaporation surface in the kettle than is required by theory gives quick heat transfer from steam to hydrocarbon liquid and increases the sensitivity of control.

The feed plate arbitrarily divides the column into two sections. The portion below is the stripping section, the column above is the fractionating section. This includes the reflux condensers. The feed, as is comes to the column, has been heated to a predetermined temperature and consists partly of liquid and partly of vapor. The vapors pass off to the fractionating trays where heavier portions are condensed and return to the feed plate. The liquid passes downward through the stripping section and encounters a successively higher temperature as it flows from plate to plate towards the reboiler, causing additional vapor to rise above the feed plate into the fractionating section. It can be seen that the liquid on the fractionating trays consist of con-

densed vapors given off by the feed as it enters the column augmented by vapors from the stripping section. In addition to these vapors and condensates, the fractionating trays handle the reflux which may be either pumped back or is a product from the partial condensers at the top of the column.

It is entirely possible to prepare a product meeting vapor pressure specifications with only a stripping section, but to do so would be at the cost of low recovery efficiencies. The vapors which arise above the point of feed are not selectively stripped. The function of the fractionating section is to eliminate the heavier portions from these vapors and return them as condensate to the stripping section. In case the kettle product is natural gasoline it should contain all the butane and heavier; the overhead vapors should consist only of isobutane and lighter. Very frequently, however, there is an excess of butane above product requirements, in which event, portions of the butane must pass as vapors from the system. In case there is a deficiency of butane in the feed, the incorporation of some isobutane in the final product is advisable. Only an ultimate analysis of the feed will tell where the split is to be made. In the absence of such analysis the quality of the product and the plant efficiency are good indications.

REFLUX TEMPERATURES

The conditions which exist on the top tray of the fractionating section determines the composition of th vapors which pass from the column. It is obvious tha if this liquid consists only of isobutane and lighter, the vapors passing to the condensers will contain only these materials. The proportion of lighter than isobutane to butane in the vapors will be greater than that in the liquid by the laws of liquid mixtures (Raoults Law). In actual practice no such ideal conditions exist and it is impracticable to return a pure component to the column as reflux. It is practicable, however, to so modify the partial condenser temperature or the operating pressure, so that a heavier or lighter liquid can be returned to the column.

If the feed liquid to the column were always of same composition and the rate constant, it would be possible by experimentation and manipulation to set the controls to give the optimum separation. Once the operating pressure has been established, the vapor pressure of

Data Necessary for Checking Column Operation

Column

1. Operating pressure, pounds per square inch ga
2. Number of plates.
3. Plate efficiency.
4. Feed connections to plates numbered from top.
5. Number of feed plates used.
6. Number of stripping plates.
7. Number of fractionating plates.
8. Average feed composition.
9. Average feed rate in gallons per hour.
10. Reflux rate gallons per hour.
11. Vapor rate, cubic feet per hour.
12. Top temperature.
13. Bottom temperature.
14. Pressure drop through column in inches of gasoline.

Reflux Condenser

1. Type—Direct return or tubular overhead.
2. Temperature of vapors to condenser.
3. Temperature of vapors leaving condenser.
4. Condensate, pounds per hour.
5. Non-condensible, pounds per hour.
6. Pressure drop, pounds per square inch.
7. B.t.u. to be transferred per hour.
8. Water temperature in.
9. Water temperature out.
10. Rate in gallons per hour.
11. Vapor rate.

Kettle

1. Type.
2. Surface in square feet of heating tubes.
3. Gasoline temperature in.
4. Gasoline temperature out.
5. Steam condensate, pounds per hour.
6. Gasoline liquid level in shell.
7. Pounds of gasoline to be heated per hour.
8. Pounds of gasoline to be vaporized per hour.
9. Total B.t.u. transfer required for heating and vaporization.
10. Steam pressure to coils.

Heat Exchangers

1. Type—Helical, multipass, tubular, or double pipe.
2. Specific gravity of liquid feed.
3. Rate of hot liquid in gallons per hour.
4. Temperature hot liquid in.
5. Temperature hot liquid out.
6. Temperature cold liquid in.
7. Temperature cold liquid out.
8. Rate of cold liquid in gallons per hour.
9. Pressure drop.

Feed Heater

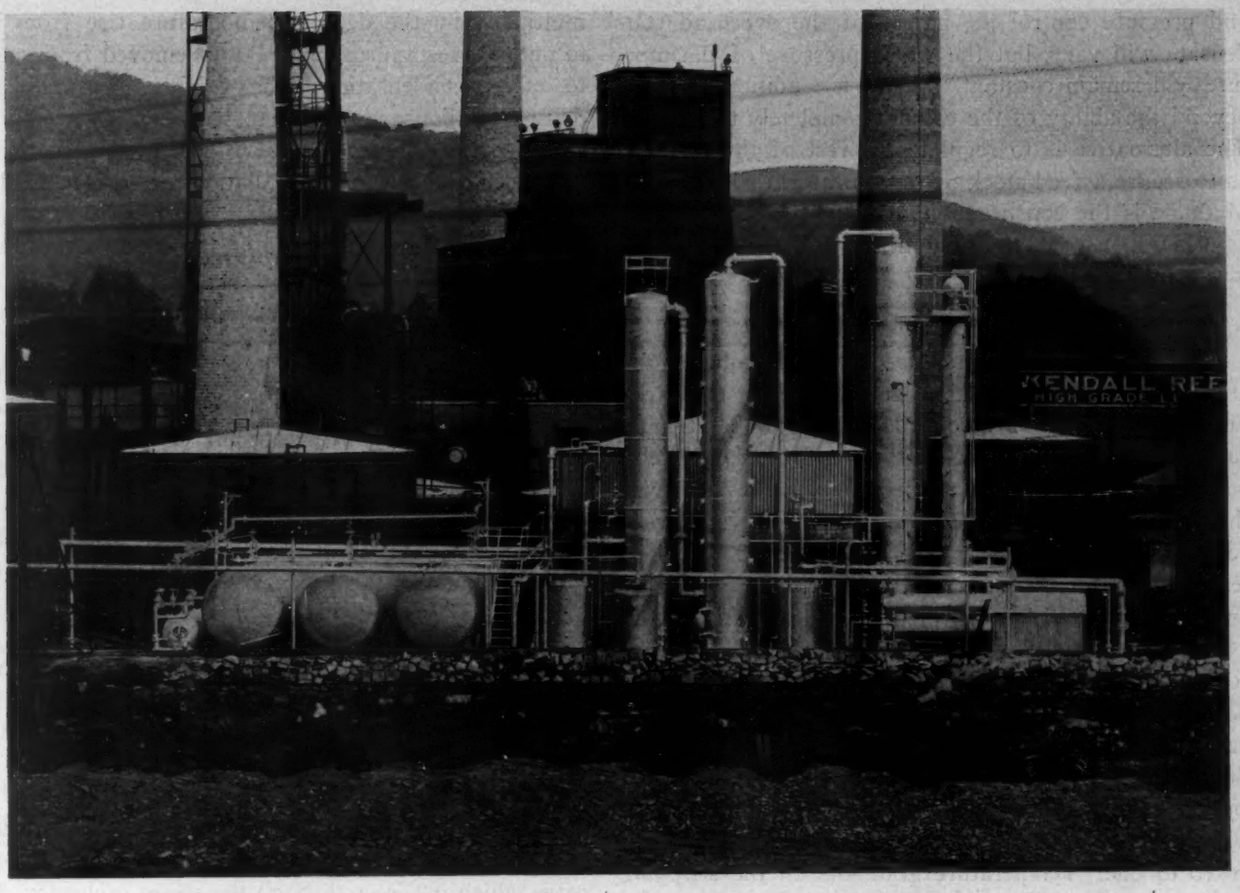
1. Operating pressure, pounds per square inch.
2. Type.
3. Liquid to be heated, pounds per hour.
4. Liquid to be vaporized, pounds per hour.
5. Temperature of liquid in.
6. Temperature of liquid out.
7. Square feet of heating surface of tubes.
8. Live steam pressure, pounds per square inch.
9. Pounds of steam condensate per hour.
10. Heat transfer, B.t.u. per hour.

Pumping Equipment

Type, capacity and w.p. of pump used for feed.
Type, capacity and w.p. of pump used for reflux.
Type, capacity, w.p. of pump used for water to reflux condenser.

Regulating and Control Equipment

1. Back pressure regulator for maintaining, operating pressure on column. Size, sensitivity and working pressure.
2. Temperature recorder—controller for kettle.
3. Temperature recorder — controller for feed heater.
4. Temperature recorder for outlet vapor.
5. Temperature control for reflux return.
6. Flow regulator for return condenser for reflux.
7. Differential recording meters for gasoline and vapors.
8. Liquid level controls for kettle.
9. Temperature recorders on plates directly above and below feed plates.



Vapor Recovery and Stabilization Unit recently completed at Kendall Refining Company's Bradford, Pennsylvania plant, by Burrell-Mase Engineering Company. The four columns are Still, Bubble Tower, Stabilizer and Lime-Scrubber.

the kettle product is a function of the temperature but the yield and distillation characteristics are more a function of the reflux which in turn is dependent upon the temperature control.

Where overhead partial condensers with water passing through the tubes are used the thermometer bulb must register the temperature change then cause some medium such as electricity or air under pressure to operate a valve which increases or decreases the cooling water rate. The cooling effect of the water must then be transferred through the metal to effect condensation and the condensate returned to the plate before the temperature reverses. The time required for this temperature control cycle is known as the "lag". The shorter the lag, the closer will be the temperature control.

A certain minimum cooling water requirement exists which can be approximated from a theoretical heat balance. The line supplying this minimum quantity should be separate from the line containing the automatic valve which furnishes the water to take up the "lag". In short, draw as smooth a line as possible on the temperature chart by hand control, then depend upon the automatic control to take up the inequalities and give a smooth line. Give the temperature recorder an occasional check with a standard instrument as a smooth line may be due to a sluggish instrument rather than close control.

The interval between maximum and minimum temperature should not be over one degree Fahrenheit in a well controlled system. At the high temperature point the reflux load is light, at low it is heavy. A large temperature interval between maximum and minimum means fluctuating load on the fractionating section and an unbalanced operation. It is best to change the size of automatic valve until one giving best results is found. It is apparent that the shorter all connections between the column and instruments, the less will be the "lag".

When a revision of the reflux temperature is considered necessary, it is best to preliminarily check its operating limits before making changes. Where the reflux to the column is furnished by returning a portion of the condensate direct to the top of the column, the operating difficulties due to "lag" are diminished. In any event the temperature on the condensers would be controlled whether overhead or separate from the column. The composition of the reflux is a function of both temperature and pressure. The composition and volume of the feed gasoline to the column determines what will be the nature of material passing from the column to the condensers as overhead vapor. Even with temperature

and pressure control the nature of the overhead condensate will vary, but the vapor pressure of the mixture will remain constant. This is a condition which is beyond the ability of the column completely to remedy. The alternative is to regulate the rest of the plant so as to secure a feed stock of more uniform composition. Methane is the constituent that gives the most trouble as it is not susceptible to rectification other than at very low temperatures.

GENERAL CONSIDERATIONS

In general most high pressure stabilizing columns operate at 250 pounds or less, depending upon the vapor pressure of the feed stock. The feed temperature is carried around 230° F. to 250° F. and the kettle temperature between 260° F. to 280° F. Vapors pass from the column to the reflux condensers somewhere between 130° F. to 150° F. and leave at 100° F to 120° F. The temperature difference between feed and kettle averages around 30° F. and between kettle and top plate 120° F. 140° F. The feed plates are about central. The average column contains between 20 and 40 plates, 30 plates being a fair average. There are usually three feed connections on alternate plates. Thus in a 30-plate column, the feed plates would be the fourteenth, sixteenth and eighteenth from the top. Plate efficiencies are somewhere between 40 and 60 per cent, reflux ratios eight or 10 to one. Temperature gradients on the stripping trays are around 2.5° F., and on the fractionating trays 6 to 7° F. When the feed is to the lower plates less reflux is required. Carrying a low feed frequently helps the yield as it brings more fractionating trays into action.

The positions of the feed plates are based upon theoretical considerations having to do with the proportion of kettle product to the amount of feed. As a generalization, when the proportion of kettle product is large compared to the total feed from accumulators, the feed should go into a point nearer the top of the column. When the feed liquid is wild and contains a large percentage of "unstable" material which passes off as vapor the injection should be on a lower plate. The product from the accumulators is usually "wild" in cold weather. In any case, if the vapor pressure of the feed runs high, lower the feed and provide for the increased load on the fractionating section.

A vapor pressure curve of the feed liquid should be a part of the daily laboratory routine. It is usually advisable to raise the feed temperature when lowering the feed plate. This will help equalize the load between the stripping sction and the fractionating section. Theoretically it is poor practice to divide the feed between two or more plates.

REFLUX RATE

Where the reflux is pumped back to the column from the partial condensate reservoir the rate may be determined by the simple procedure of metering the return liquid. For the overhead type, reflux condenser with water through the tubes, the weight of water in pounds multiplied by the degrees temperature rise from inlet to outlet gives approximate B.t.u. removed from vapors to effect condensation. The volume of vapors condensed in thousands of cubic feet is roughly approximated by dividing the total B.t.u. thus calculated by 22,000. The more exact calculations are rather involved.

The amount of vaporization may also be estimated from the heat input based on heat exchange and weight of steam condensate. Every pound of steam on condensation yields a definite amount of heat, the amount varying with the pressure. At 90 pounds gauge one pound of live steam liberates 888 B.t.u. on condensation. The steam condensate from the preheater and the kettle are the sole sources of heat input. The total number of pounds condensed multiplied by 888 and divided by 22,000 gives an approximation of the amount of vaporization. The reflux ratio is increased by putting more heat into vaporization and taking more heat out in condensation.

Better yields sometimes result from forcing the column due to the increase in the reflux ratio. When increasing the reflux ratio it is better to lower the feed plate to provide for the increased load on the fractionating section.

FEED PREHEATER

The feed liquid from the accumulator tanks usually passes through heat exchange with the kettle product after which it passes through the steam preheater. How high is it advisable to heat the feed to the columns? Inasmuch as the feed plates are placed somewhat central, temperatures 25 to 40 degrees higher than the kettle are considered sufficient. This is no set rule and the operation may be modified to suit unusual conditions. The kettle and the feed preheater work in conjunction. Increasing the feed temperature throws a heavier load on the fractionating trays. Where the feed stock is of relatively low vapor pressure, better results will be obtained with a smaller temperature difference between the feed and the kellte insofar as column capacity is concerned. The aim should be to divide the load equally between the exhausting and the rectifying sections.

A higher feed temperature than kettle temperature is never warranted. Fractionation requires a progressively higher temperature for each plate from top to bottom. When one is not getting the results anticipated, give the column more steam through the kettle and more reflux at the top as it is upon vaporization and condensation that fractionation depends. If properly designed, the high pressure stabilizer will have sufficient flexibility to withstand some "forcing."

However, as stated in a previous article (Ref. and N. G. M., August, 1931, page 82) it is well not to be too hasty in laying all blame upon the stabilizer as conditions further back in the plant may need remedying. As far as continuous fractionation of any type is concerned, whether vacuum, atmospheric or high pressure, a steady flow of uniform composition is of paramount importance to highest operating efficiencies.

Rapid Refinery Development Takes Place in East Texas

By H. H. KING
Staff Representative

CRUDE refining capacity in Texas has been increased slightly more than 100,000 barrels daily since the first of the year through the construction of a greater number of plants than at any time previous during a similar period. During the first eight months of the year work has been completed, or started, on 37 plants, ranging in size from 50 to 15,000 barrels daily, and with few exceptions this expansion activity has been carried out by small companies and individuals who were attracted by the presence of an abundant supply of crude at low prices. In addition to the above plant activity there have been built more than 100 miniature crude refineries, consisting of steel drums serving as cooking vats that are being used by small operators and farmers in Central West Texas in making their own gasoline and distillate requirements. The products turned out by these "Tom Thumb" type of plants, which range from one to two barrels capacity, are of a serviceable quality, if not meeting accepted standards. Owners evade the 4-cent gasoline tax of the state, with few exceptions.

This unusual outbreak of refinery construction had its beginning early in the year when normal markets for crude production were lost entirely, or curbed to a low level by purchasing agencies. Producers then elected to engage in the refining business, or make the oil available to those having funds to install plants, as a means of creating a market outlet. Many of these plants have adversely affected the gasoline price structure in their respective districts, and the East Texas group had developed a dominating influence over the price structure throughout the Southwest, Southeast and Middlewest at the time a complete shutdown of the East Texas field became effective on August 17.

Abundance of high gravity crude that yields 36 to 40 per cent U. S. motor gasoline by skimming offered by the East Texas field at takers' prices proved to be a magnet for skimming plants. Plant building started early in the year and the number had increased to 20 late in August.

There were 15 plants on production when the military shut-down for the field took place. The remaining five are scheduled to be completed in September. These 20 plants have a combined capacity of 81,250 barrels daily, but will not be operated in the future at any daily volume approaching this level as long as proration is enforced in the field, as the production allowance of well connections available for these plants will never permit maximum operations.

BIG PROFITS IN PROSPECT

East Texas plants were in line to make a rich harvest, and many of those on full time operations early in August were showing net earnings that would pay out the cost of the plants within 30 days. Owner of a plant rated at 10,000 barrels daily was in line to show a net profit of $50,000 during the month of August should the crude supply have been available throughout the month. Earnings from fuel oil production of this plant were almost nothing, owing to the distressed condition of the market from this high cold test product. A few of the original plants in the district have long time fuel oil contracts with railroads ranging up to 45 cents per barrel.

Texas Panhandle's lone addition to its group of plants

Oil burning type of one-barrel refinery used in Central West Texas, showing method of gravitating fresh crude from platform to "still".

was largely due to the failure of Sunray Oil Corporation to attract a market outlet for its shut-in production in the Dumas field, Moore County, although a pipe line had been built into the area from Borger. The above company made a contract for Apache Refining Company, California, to build a 5000-barrel plant at Sunray (Altman) and process the crude on a flat cost per barrel. Since completion of this plant competition has appeared on the horizon for its limited crude supply.

Failure of operators in North and Central West Texas to obtain market relief from major pipe line companies for production allowed under proration proved to be a contributing factor for the dozen small plants listed. Owners of these plants have a controlled supply of crude only in a few instances, and many will go on the inactive list should the supply become scarce and at a high price.

Ewmo Oil Corporation built its 1000-barrel plant at

Refinery Construction Activity In Texas During 1931

EAST TEXAS

Company—	Daily Capacity	Plant Location	Railroad Connection
Arrow Refining Company, Fort Worth	2,500	Overton	I-GN
Beacon Oil & Refining Company, Henderson	2,500	NW Henderson	I-GN
Blue Ribbon Refining Company, Dallas	1,000*	Kilgore	I-GN
Boone Refining Company, Arp	500	Arp	I-GN
Central Refining Company, Dallas	10,000	Friar	I-GN
Citizens Refinery Company (Geo. Ames) Gladewater	800	Gladewater	T&P
Constantine Refining Company, Dallas	2,500	Overton	I-GN
East Texas Refining Company, Dallas	12,000	Longview Junc't.	Santa Fe
East Texas Refining Company, Dallas	6,000	Friar	I-GN
Gladetex Refining Company, Gladewater	750	Gladewater	T&P
Heartfield Refining Company, Shreveport	1,000*	Camps Switch	T&P
Indian State Oil Company of Texas, Dallas	1,000	Gladewater	T&P
Kilgore Refining Company, Fort Worth	1,500	Kilgore	I-GN
Overton Refining Company, Overton	3,500	Overton	I-GN
Petroleum Refractionating Corporation, Ft. Worth	10,000*	Footes	I-GN
Rusk Refining Company, Overton	3,000	Overton	I-GN
Sinclair Refining Company, Fort Worth	5,000	Gladewater	T&P
Slack Petroleum Company, Tulsa	2,500	Camps Switch	T&P
Southern Oil Refining Company, Longview	200	Reeds Switch	I-GN
Taylor Refining Company, Tyler	15,000	Tyler	Cotton Belt

CENTRAL TEXAS

Master Petroleum Company, Waco	1,000	Waco	Cotton Belt

GULF COAST

Republic Oil Refining Company, Houston	5,000	Texas City	.....

CENTRAL WEST TEXAS

Bluebonnett Refining Company, Brownwood	200	Brownwood	.....
M. D. Carson, Brady	150	Brady	.....
Echotex Refining Company, Echo	300	Echo	.....
Goss Brothers, Rising Star	50	Rising Star	.....
Mid-Texas Petroleum Corporation, Oklahoma City	250*	Eliasville	W. F. & S.
O-Bar Refining Company, Coleman	500†	Coleman	Santa Fe
Sinclair Refining Company, Fort Worth	5,000	Fort Worth	F. W. & D.
Wilson & Swain, Woodson	50	Woodson	.....

WEST TEXAS

Concho Refining Company, San Angelo	500	San Angelo	Santa Fe
Ewmo Oil Corporation, Abilene	1,000	Hawley	A. & W. V.

NORTH TEXAS

Belknap Refining Company, New Castle	150	New Castle	W. F. & S.
Norgold Refining Company, Olney	200	Olney	W. F. & S.
Seymour Refining Company, Seymour	250*	Seymour	.....
Will C. Young Refining Company, Archer City	250	Archer City	W. F. & S.

TEXAS PANHANDLE

Apache Refining Company, Tulsa	5,000	Sunray	R. I.

*Plant building.
†Re-building old plant.

Miniature refinery of the double-barrel type, using natural gas for fuel, with vapor line leading to water barrel for condensing.

Hawley to provide a market outlet for production owned by the company in a nearby pool after having failed to get relief from other sources.

MINIATURE PLANTS

More than 100 miniature crude refineries have put in their appearance on oil leases and on farms in Central West Texas since spring as a direct result of high gravity crude in the district having suffered a slump in demand and declined to record low prices. Operators and farmers learned that steel oil drums, and also the type used by oil companies in distributing gasoline, kerosene and lube oil to wholesale buyers, served as a substitute still for extracting a quality of gasoline and kerosene from crude that could be used successfully in drilling and pumping engines, autos and tractors. Installations grew in numbers with the decline in crude prices, and the units afforded fuel in abundant quantities at very low cost and tax-free.

These "Tom Thumb" refineries invariably are of a makeshift arrangement with economy being practiced to the maximum by those electing to manufacture their own fuel supplies. The usual procedure is to gain possession of a drum, without cost, and partially submerge it in a pit, with rocks used as a buffer at the contact point of the drum with the banks of the pit. A two-inch pipe is welded to the top side of the drum to serve as a vapor line in carrying off the light fractions to an improvised condensor barrel. A second opening is made on the top side of the drum to permit gravitation of fresh crude into the container when a batch has been taken off. The drum is embedded in the pit so that the usual opening at the top is near the ground, thus providing an outlet for draining off the residue, which is used as fuel for the next batch, or in some instances as a lubricant for oil field equipment.

Some still owners have elected to fire the plants with natural gas when it is available, while the majority use residue, or fresh crude by elevating a container directly above the head of the drum, then allowing the oil to drop with a splash under the still. A chimney is installed at the rear of the fire box to afford the necessary draft. With a well regulated fire, the crude contents of the still reaches the boiling point in a brief period, and the vapors pass over via the pipe line through a water barrel, then into storage barrels, or buckets. Several batches per day can be run off with these units, and a recovery of 15 gallons of gasoline and 12 gallons of kerosene distillate from a barrel of crude is not out of the ordinary.

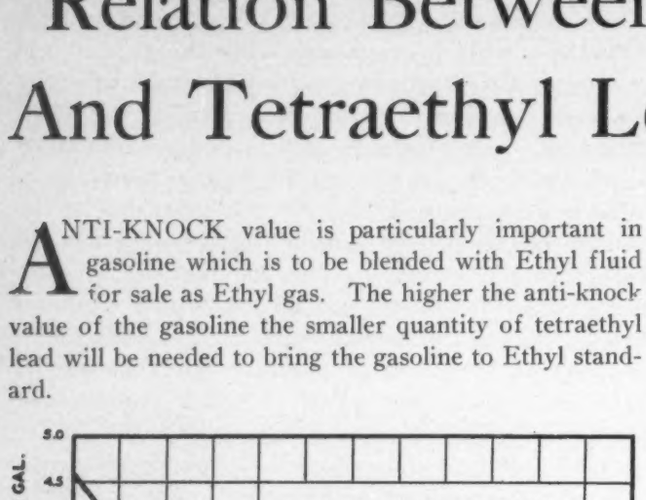
One of the first jitney plants to be operated was near isolated high gravity crude production in Taylor County, near Abilene. Adams-Ferguson & Hobbs producers on the Lowe lease could only get 36½ cents per barrel for their 41 gravity crude loaded aboard tank cars, but by selling to local farmers that had provided makeshift stills, a flat price of $1.00 per barrel at the well could be had for the same oil. At one time about 30 separate customers were buying oil from this lease, and some of the still owners went further in commercializing their art by turning out batches for neighbors at 75 cents per barrel.

Shallow lease owners in the Moran, Putnam and other areas in Central West Texas rapidly took to the idea of making their own engine fuel requirements, and many built up such a demand that two drums were welded together to afford a doubled output. This home-made motor fuel escaped the state tax of four cents per gallon as an added inducement for operators to turn out their own requirements. A number of the still operators conceived the idea of avoiding all waste, so dumped the residue oil into lease storage tanks after skimming off the light fractions to be sold to the pipe line companies serving such leases. This idea cost some of the operators their pipe line connections temporarily when purchasers learned of the practice.

A real hazard is involved in operating these jitney refineries under high temperature should the vapor line become clogged, and a few have exploded. Introduction of this short route to cheap fuel supply in the West Texas district resulted fatally for Jas. Miller of El Paso, who was burned June 17 while working with a barrel still on the C. L. Dittman lease in the Pecos Valley pool, Pecos County. Don Dittman, son of the lease owner, was painfully burned also. A number of still attendants in Central West Texas sustained minor burns while drawing off the hot residue from the drum to make ready for a new batch of crude to be cooked, as this hot oil would burst into a flame when exposed to the air.

Relation Between Octane Number And Tetraethyl Lead Requirements

ANTI-KNOCK value is particularly important in gasoline which is to be blended with Ethyl fluid for sale as Ethyl gas. The higher the anti-knock value of the gasoline the smaller quantity of tetraethyl lead will be needed to bring the gasoline to Ethyl standard.



The importance of adding a few points of octane number in the range between 66 and 74, as compared, say, with adding it between 52 and 56, is shown in the accompanying graph.

Any given octane number can be converted to the corresponding "lead" requirement by the use of the curve. This curve shows the relation between octane number and tetraethyl lead requirement.

For example: 74 octane number requires no tetraethyl lead because the gasoline is equal to Ethyl standard.

Similarly, 55 octane number represents a gasoline that requires 3 cc. of Ethyl fluid to bring it to the Ethyl standard.

In using this curve it should be appreciated that the relationship varies somewhat with gasolines from different crudes due to different lead susceptibility, but this curve gives an approximation which serves most purposes.

EDITOR'S NOTE: The foregoing is an excerpt from a paper prepared by E. F. Nelson and Gustav Egloff, and released to the trade press July 10 by Universal Oil Products Company. Because it is a handy reference chart for easy calculations where laboratories report the number of cubic centimters of tetraethyl lead to bring a given fuel to Ethyl standard (as is very often the case) the chart and discussion of its use are presented here.

Heat Exchanger Used in Sediment Removal

(*Continued from page* 85)

the coils, entering the first bundle at the bottom, then passes from it through a suitable pipe connection to the outside of the shell, to return to the second compartment flowing through the bundle there, being cooled in its passage through both batteries of coils from 650°F., the entry temperature, to 150° at the outlet to be delivered to the storage battery.

The cold fresh charging stock with a gravity of 29/30 is first pumped through a small tank having coils inside through which the oil travels, condensing a part of the exhaust steam from the pumps, bringing the temperature up slightly on the oil, to enter the shell of the combination apparatus, thus flowing in counter current with the residuum. The velocity of the charging stock is lowered while it passes through the tank and around the coils, acquiring a temperature of 225°F. in its passage through both compartments before it enters the first shell still.

Whether or not the boiling point of the sodium chloride solution increases in direct proportion to its concentration, practically all of it may be drawn from the bottom of the compartments, bringing all of the floating sand with it. As a heat exchanger, it is not so very efficient, but in settling out the sand and disposing of the salt water, it is doing the work.

A small cut of light gasoline is taken from this tank through two connections leaving the shell one on each side of the baffle placed in the center of it. These connections converge and arise upon which a small bubble tower is placed supported by a steel derrick. This tower is 30 inches in diameter by 16 feet in height, having six trays with one large bubble cap with serrated edges placed in the center of each plate.

THE MONTH IN REVIEW

Help Rumanian Refiners With Tax

THE Rumanian Parliament recently passed a law designed to aid the petroleum refining industry in that country. The law provides for the collection of a tax by refiners, details of which are lacking, but this tax is then paid by the refiners to the government, which in turn reapportions the tax back to the refining companies. Rumanian refiners are divided into three groups, the first of which are small producers running 100 tons (approximately 700 barrels) per day and under, then a second group with production of 1000 tons daily, and a third group of producers handling from 1000 to 1500 tons per day. Refiners in each class will receive varying amounts from the proceeds of the new tax with the smaller refineries receiving greater amounts of financial support. Producers above 1500 tons daily will not share in the disbursement of these tax moneys.

Brazil Requires Alcohol Blend

THE Brazilian government his issued an order requiring that 50 per cent of the alcohol production must be denatured with gasoline and used as a motor fuel. With the former law specifying that five per cent of alcohol must be blended into gasoline it is said that one or other of the orders must be suspended inasmuch as alcohol production of proper specification is insufficient to satisfy blending demand. Reports state that the new law requiring 50 per cent of alcohol production to be blended with gasoline will force both the price of gasoline and alcohol to higher levels.

Two Large Mergers Near

MERGER negotiations came to the forefront in the petroleum industry during August under such conditions that their completion can be accepted as ready for completion. Most prominent among the merger efforts were the California and New Jersey companies of the Standard Oil group and the Sinclair-Prairie consolidations. While others had brief mention, events in the above two were such that they seem assured.

President of the two Standard Oil companies met in California and statements were finally issued leaving no doubt that it is the desire of officials of the two concerns to weld them into one organization. The two concerns would put together two of the world's largest refining concerns.

Other than a statement by Axtel J. Byles, president of Tide Water-Associated Oil Company to the effect that his company had under consideration a merger with Sinclair and Prairie, no official statement was forthcoming on this deal. This statement admitted no more than the fact that preliminary considerations had been taken.

In financial circles Sinclair Consolidated Oil Corporation, Prairie Oil & Gas Company, Prairie Pipe Line Company, Tide-Water Associated Oil Company and Rio Grande Oil Company have been given exceptional publicity. Prices of stocks of these concerns as quoted on the exchanges would indicate that the securities of the five are being weighted against each other.

Through the department of Justice the United States government announced that it would take cognizance of these two mergers. Since this activity is a formality in all mergers of importance, little significance was attached to it, for legal barriers are considered of little consequence in either of the mergers.

Panhandle Gas To New England

CONTINENTAL Construction Company, formed by Standard Oil Company of New Jersey, Cities Service Company, Skelly Oil Company, Phillips Petroleum Company and others, for handling natural gas deliveries out of the Panhandle of Texas, plans another gas line from the Texas gas fields to the New England states.

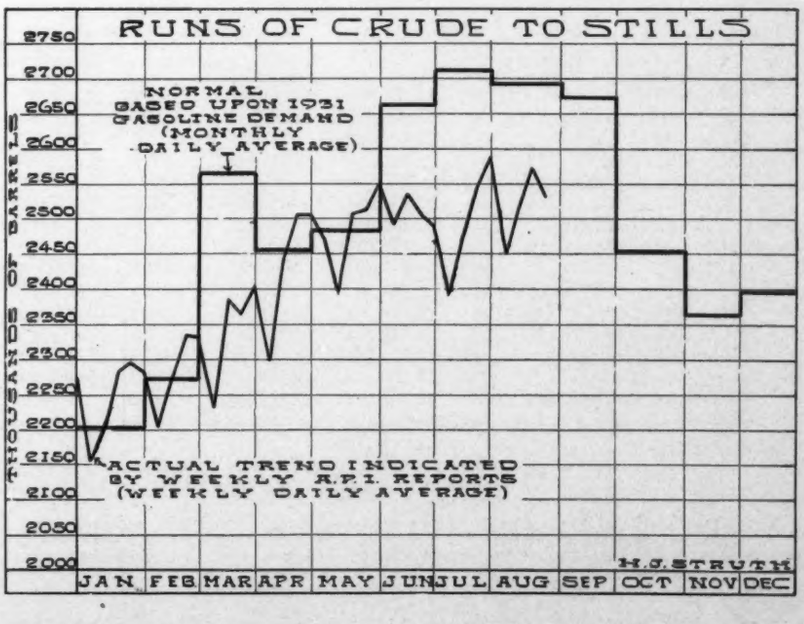
The company has about completed its 24-inch line from the Panhandle to Chicago, started in 1930, and expects to begin deliveries this month. Reports state that the second carrier will parallel the present line, will be of 30-inch pipe, and that the project will be started in 1932. Upon completion it will be the longest natural gas line in the world.

ECONOMICS

Enough Gasoline Stocks for 28 Days

STOCKS of gasoline at refineries in the United States, as of July 31, were sufficient to last but 28 days, according to the July statement of the Bureau of Mines. On that date, the industry had 40,332,000 barrels of gasoline at refineries. This figure represents a decline under stocks on hand June 30 of nearly 4,000,000 barrels and amounts to a reduction under stocks of gasoline held on July 31, 1930, of approximately 6,000,000 barrels.

An index of the total quantity of gasoline on hand in the United States is now available through statistics obtained by the American Petroleum Institute which show how much gasoline is in storage at bulk terminals and also the quantity in transit. Figures for August 1 show that stocks of gasoline at bulk terminals amounted to 11,765,000 barrels, while gasoline in transit aggregated 2,305,000 barrels. Accordingly, the total quantity of gaso-



Cracked Gasoline Production

Week Ending Aug. 22, 1931
(Barrels of 42 gallons)

District	Potential Cracking Capacity Daily Reporting Total	Daily Reporting Per Cent	Per Cent	Production Total	Daily Average
East Coast	261,300	236,300	90.4	639,000	91,300
Appalachian	56,300	54,100	96.1	179,000	25,600
Ind., Ill., Ky.	330,400	315,400	95.5	656,000	93,700
Okla., Kans., Mo.	237,800	219,500	92.3	434,000	62,000
Texas	450,800	436,200	96.8	853,000	121,800
Louisiana-Arkansas	112,400	112,400	100.0	228,000	32,600
Rocky Mountain	99,100	97,600	98.5	96,000	13,700
California	190,800	190,800	100.0	265,000	37,900
Total week Aug. 22	1,738,900	1,662,300	95.6	3,350,000	478,600
Total week Aug. 15	1,734,900	1,652,300	95.2	3,285,000	469,300
Total week Aug. 8	1,724,900	1,642,300	95.2	3,292,000	470,300
Total week Aug. 1	1,724,900	1,645,300	95.4	3,305,000	472,200
Total week Aug. 23	1,589,200	1,334,900	84.0	2,677,000	382,400
The Texas and Louisiana Gulf Coastal Figures Shown Below are included above in the totals of their respective districts.					
Texas Gulf Coast	352,400	347,400	98.6	668,000	95,400
Louisiana Gulf Coast	77,000	77,000	100.0	162,000	23,100

line in storage in the United States on August 1 was approximately as follows:

At refineries	40,332,000
Bulk terminals	11,765,000
In transit	2,305,000
Total	54,402,000

While refinery supplies of motor fuel only amounted to a supply of 28 days, the additional quantity of gasoline outside of refineries amounts, roughly, to a supply equivalent of 10 days in total consumption. It is apparent, therefore, that the total supply of gasoline actually is equivalent to 38 days of consumption.

Natural Gasoline Output Down

NATURAL gasoline plants of the United States continued to curtail production of that product during July, having produced a daily average during that month of only 4,770,000 gallons. This represented a decline under the daily output for June of about 160,000 gallons. Total production of natural gasoline during July amounted to 147,900,000 gallons, or the same total recorded during June. Compared with July, 1930, natural gasoline production has been reduced to the extent of about 1,000,000 gallons a day.

Despite the reduction in production schedules, stocks of natural gasoline have increased above the quantity in storage last year. Expressed in barrels, Bureau of Mines figures for July show that natural gasoline stocks at the end of that month amounted to 855,000 barrels, against 741,000 barrels at the same time last year.

The decline in natural gasoline production since the first of the year has amounted to more than 4,000,000 barrels, compared with last year.

Lubricant Sales Gain in July

DOMESTIC sales of lubricating oil showed a material gain during July when total demand amounted to 1,969,000 barrels, a gain over June of 354,000 barrels. Daily average consumption of lubricating oils in July increased 10,000 barrels—from 54,000 barrels in June to 64,000 barrels in July. As a result, stocks of lubricants declined 166,000 barrels to a total of 9,597,000 barrels. When compared with last year, stocks of lubricants show a net decline of 360,000 barrels.

An unfavorable factor in the statistics for July, however, was a further slump in export sales. During that month exports declined to 535,000 barrels, against 833,000 barrels in June—a slump of 11,000 barrels a day.

Continued high rates of production have apparently obscured any hope for improvement in the lubricating oil situation. Production of lubricants during July amounted to 2,337,000 barrels, a gain over June output of more than 250,000 barrels. It would seem that the

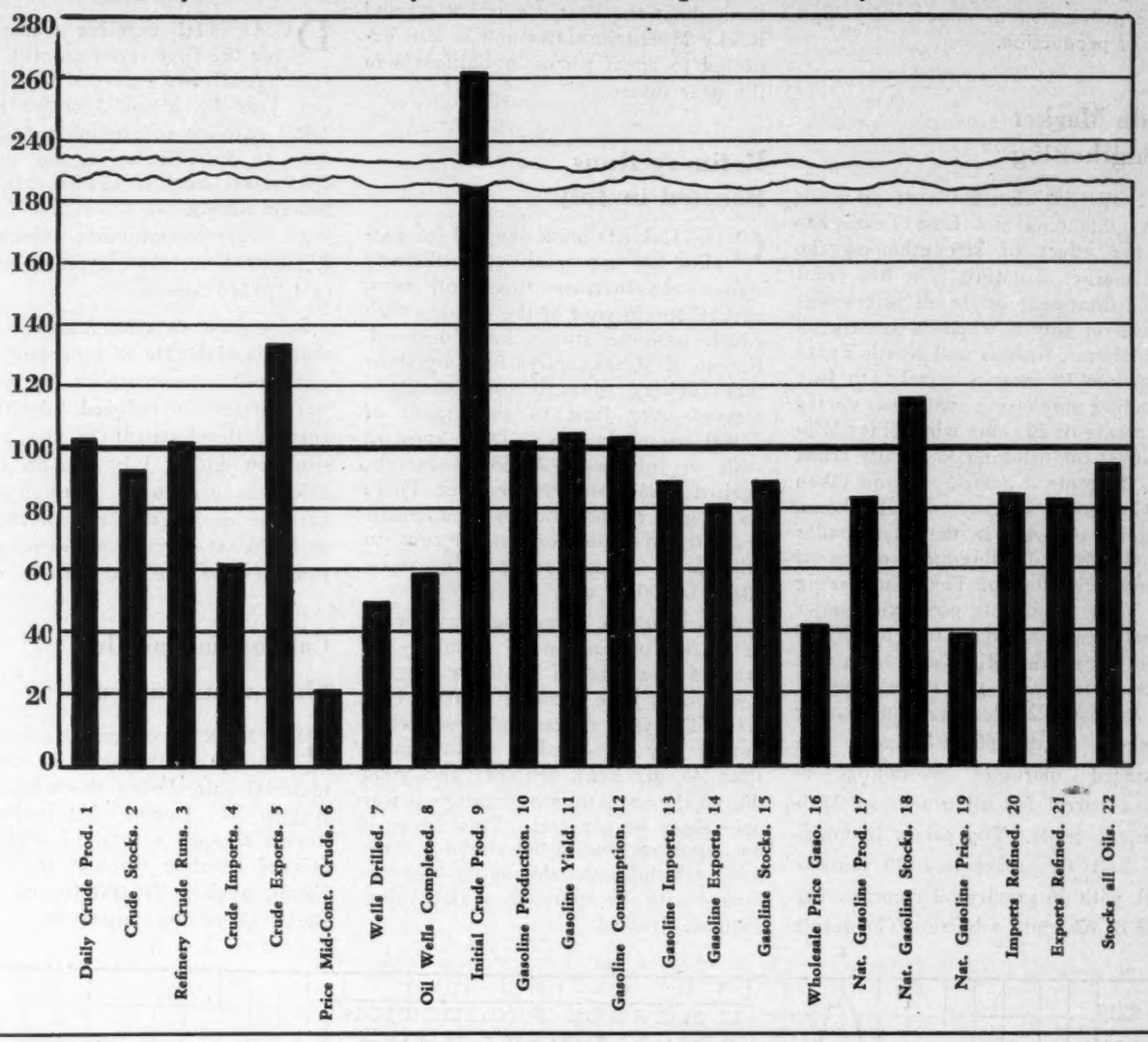
Crude Runs to Stills, Gasoline Stocks and Gas and Fuel Oil Stocks

Week Ending August 22, 1931
(Barrels of 42 gallons)

District—	Potential Capacity (Daily) Reporting Total	Reporting Per Cent	Per Cent	Crude Runs to Stills Total	Daily Average	Per Cent Operated	Gasoline Stocks (see note below)	Gas & Fuel Oil Stocks
East Coast	633,700	633,700	100.0	3,131,000	447,300	70.6	5,086,000	10,959,000
Appalachian	149,600	137,400	91.8	780,000	111,400	81.1	1,271,000	1,470,000
Ind., Ill., Ky.	436,300	431,500	98.9	2,334,000	333,400	77.3	5,169,000	4,280,000
Okla., Kans., Mo.	485,700	435,200	89.6	2,158,000	308,300	70.8	2,477,000	5,167,000
Texas	838,200	765,400	91.3	3,760,000	537,100	70.2	6,587,000	11,317,000
Louisiana-Arkansas	233,100	230,500	98.9	1,295,000	185,000	80.3	707,000	3,224,000
Rocky Mountain	159,400	142,300	89.3	401,000	57,300	40.3	1,334,000	821,000
California	912,500	880,100	96.5	3,350,000	478,600	54.4	*11,437,000	97,567,000
Total Week Aug. 22	3,848,500	3,656,100	95.0	17,209,000	2,458,400	67.2	34,068,000	134,805,000
Total Week Aug. 15	3,848,500	3,656,100	95.0	17,477,000	2,496,700	68.3	34,534,000	134,860,000
Total Week Aug. 8	3,848,500	3,656,100	95.0	17,077,000	2,439,600	66.7	35,881,000	132,979,000
Total Week Aug. 1	3,848,500	3,656,100	95.0	16,669,000	2,381,300	65.1	36,742,000	133,386,000
Louisiana Gulf Coast	147,500	147,500	100.0	869,000	124,100	84.1	595,000	2,152,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.								
Total Aug. 23, 1930	3,686,400	3,525,400	95.6	17,861,000	2,551,600	72.4	39,842,000	139,966,000
Texas Gulf Coast	532,500	531,500	99.8	2,836,000	405,100	76.2	5,472,000	7,991,000

NOTE: In all the refining districts indicated except California, figures in this column represent gasoline stocks at refineries. In *California, they represent the total inventory of finished gasoline and engine distillate held by reporting companies wherever located within Continental United States—(stocks at refineries, water terminals and all sales distributing stations, includnig products in transit thereto).

Salient Oil Industry Factors for July, 1931, Expressed in Per Cent of July, 1930. Heavy Line (100) Represents July, 1930



Oil Industry Barometer—July, 1931

Index of Salient Factors—Current and Cumulative

	Factors—	This Month			7 Months Ending July 31		
		Last Year	This Year	Index (1)	Last Year	This Year	Index (1)
1	Daily Average Crude Production (Thous. Bbls.)	2,469	2,515	102	2,559	2,356	92
2	Total Crude Stocks (Thous. Bbls.)	530,135	489,935	92	530,135	489,935	92
3	Refinery Crude Runs (Thous. Bbls.)	78,644	79,758	101	556,301	518,093	93
4	Crude Imports (Thous. Bbls.)	5,877	3,588	61	37,007	29,097	79
5	Crude Exports (Thous. Bbls.)	1,973	2,621	133	14,067	14,474	103
6	Posted Price 36 Gravity Mid-Cont. Crude (Per Bbl.) (2)	$1.29	$.26	20	$1.29	$.61	47
7	Wells Drilled*	1,837	899	49	14,260	7,497	53
8	Oil Wells Completed*	930	545	59	8,012	3,904	49
9	Initial Crude Production (Thous. Bbls.)*	1,160	3,032	261	6,476	15,645	241
10	Gasoline Production (Thous. Bbls.)	38,061	38,440	101	261,378	250,366	96
11	Gasoline Yield—Average Per Cent of Crude (4)	42.58	44.11	104	41.59	43.57	105
12	Domestic Gasoline Consumption (Thous. Bbls.)	38,352	39,459	103	227,959	230,964	101
13	Gasoline Imports (Thous. Bbls.)	1,741	1,528	88	9,899	8,561	86
14	Gasoline Exports (Thous. Bbls.)	5,598	4,473	80	40,502	28,372	70
15	Gasoline Stocks at Refineries (Thous. Bbls.)	46,077	40,332	88	46,077	40,332	88
16	Refinery Price U. S. Motor Gaso.—Group 3 (Cents)	6⅝	2¾	41	7(3)	3¼(3)	46
17	Natural Gasoline Production (Thous. Bbls.)	4,231	3,521	83	30,683	26,499	86
18	Natural Gasoline Stocks (Thous. Bbls.)	741	855	115	741	855	115
19	Price Grade "A" Natural Gasoline, Group 3 (Cents)	5½	2⅛	39	6(3)	2½(3)	42
20	Imports of All Refined Oils (Thous. Bbls.)	4,040	3,435	85	25,627	22,719	89
21	Exports of All Refined Oils (Thous. Bbls.)	11,041	9,135	83	82,332	60,213	73
22	Total Stocks of All Oils (Thous. Bbls.)	692,887	649,205	94	692,887	649,205	94
	Weighted Index of Supply	.....	.....	106	.....	.....	105
	Weighted Index of Demand	.....	.....	100	.....	.....	91
	Weighted Index of Prices	.....	.....	33	.....	.....	45

*Exclusive of Rocky Mountains. (1)—Last Year—100.
(2)—Weighted Average. (3)—Monthly Average.
(4)—Straight run and cracked gasoline only.

real solution for improvement in the lubricating oil business lies not in spectacular, price-cutting sales tactics but in the prevention of unnecessary high rates of production.

Crude Market Strengthening

ENFORCED shut-down of oil wells in Oklahoma and East Texas has had the effect of strengthening the crude market structure. The low point of Mid-Continent crude oil prices was reached on July 8, when 36 gravity oil in Oklahoma, Kansas and North Texas declined to 18 cents a barrel. On July 24, leading purchasing companies posted an increase of 20 cents a barrel for Mid-Continent oil, bringing 36 gravity crude up to 38 cents a barrel. Action taken by Governor Murray of Oklahoma in placing oil wells in that state under martial law and subsequent action of Governor Sterling of Texas in placing East Texas producing properties under martial law has had the effect of strengthening the Mid-Continent crude market structure to some extent. On August 22, leading purchasing companies in the Mid-Continent area announced increases averaging 24 cents a barrel for all grades of Mid-Continent crude. Top prices in Oklahoma and Texas are now 70 cents a barrel, with 36 gravity oil commanding a rate of 62 cents a barrel. The result of curtailed production in the Mid-Continent area has had a favorable influence upon the crude market structure throughout the East, Central West and Rocky Mountain states and is also expected to affect prices in California in the near future.

Refinery Runs Boosted in July

CONTINUED brisk demand for gasoline has apparently spurred many refiners to increase their still runs, particularly in view of the rapidity with which gasoline stocks have declined. Bureau of Mines figures for July show that refinery runs to stills were increased over June to the extent of 32,000 barrels a day. Total runs to stills in July were 79,758,000 barrels, against 76,237,000 barrels in June. There was a gain in the quantity of domestic crude runs, while foreign oil runs to stills were further reduced by about 10,000 barrels a day.

As a result of increasing runs during July, the production of gasoline increased to a total of 38,440,000 barrels, a gain over June of about 1,400,000 barrels. The yield of gasoline from crude during July amounted to slightly more than 44 per cent, whereas the yield during the same month of last year was only about 41 per cent. This factor is an important one in determining operating schedules and should not be overlooked with the approach of slackening gasoline demand.

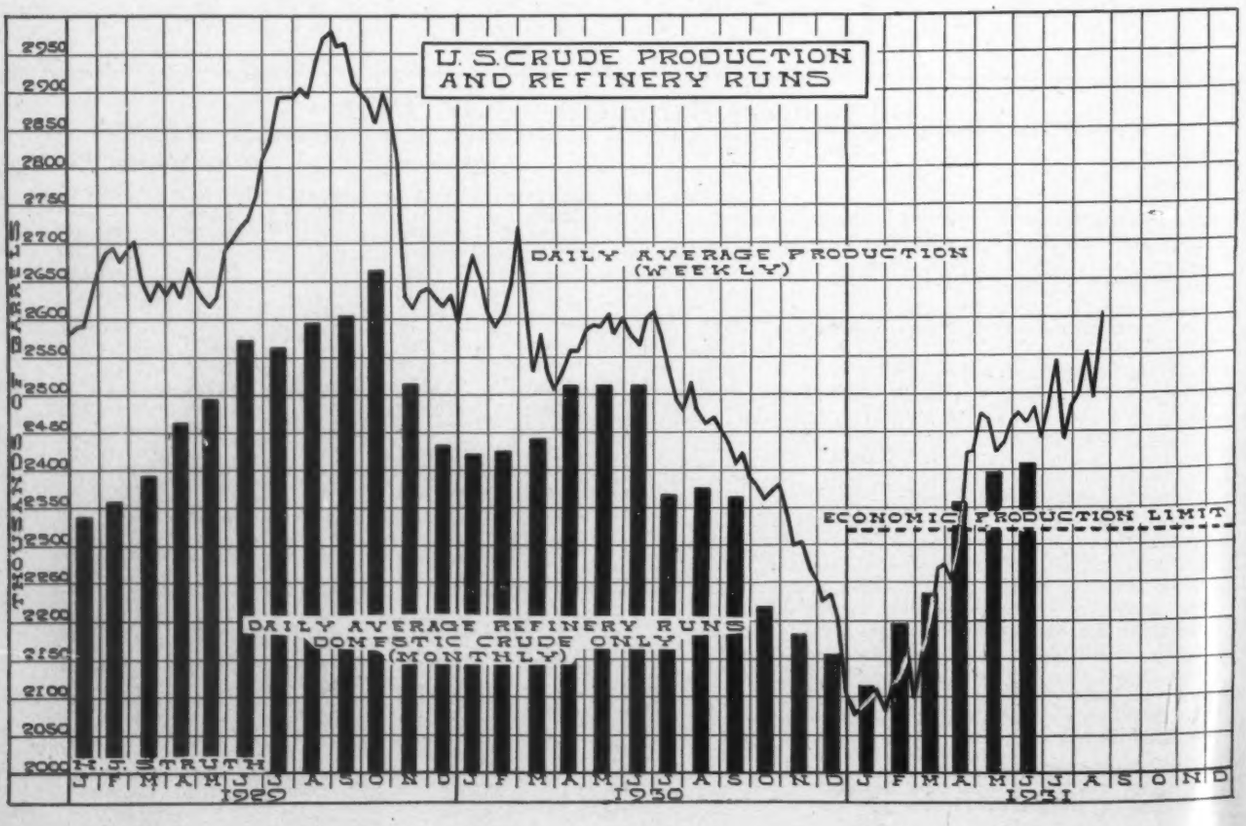
Gasoline Demand Continues Brisk

DOMESTIC gasoline consumption for the first seven months of this year has already exceeded the total for last year by about 3,000,000 barrels. Total gasoline consumption from January to July, inclusive, amounted to 230,964,000 barrels, against 227,959,000 barrels during the same period of last year. July consumption amounted to 39,459,000 barrels, an increase over June of 1,100,000 barrels.

Subsequent data for August indicates that this high rate of consumption was continued, since stocks of gasoline were materially reduced. Another favorable development in the gasoline situation during July was an appreciable gain in exports. Foreign sales of gasoline during that month amounted to 4,473,000 barrels, an increase over June of over 1,200,000 barrels.

California Gasoline Shipments Increase

SHIPMENTS of gasoline from California to Atlantic ports showed a material gain during the week ending August 29. During that period, California shipped a total of 409,000 barrels of gasoline through the Panama Canal, against 279,000 barrels during the week ending August 22.



▼ TECHNOLOGY ▼

Hydrogenation, Its Progress in England

Following an editorial appearing in these columns last month, in which the statement was made that already English synthetic gasoline from the hydrogenation process can be put on the market to compete in price with natural motor fuel of comparative quality, doubt was expressed by some readers as to possible verification of that assertion. The editorial (Ref. & N. G. M. Aug. 1931, page 69) pointed to the fact that such influences as ocean freight rates, tariffs on imported oils in foreign countries, the price of coal, the cost of operating the synthetic process, and the price of crude, might easily become contributing factors to the successful commercial application of the hydrogenation process abroad.

It is interesting to note that under date of August 10, 1931, H. McGowan, chairman, Imperial Chemical Industries, Ltd., virtually substantiated those statements appearing in the editorial cited, in a letter to the editor of Petroleum Times, London, England, which is reprinted below:

"Sir,—So much interest is being shown at the moment in the question of hydrogenating British coal into oil fuels that, as chairman of the company which has done all the large-scale work on hydrogenation in this country, I may perhaps be allowed to clarify the position by making the following points:—

"Hydrogenation has already reached the stage at which we have a plant at Billingham capable of dydrogenating 15 tons or more per day of bituminous coal. Of the clean, dry coal so treated, some 60 per cent by weight is recovered as refined petrol, which has been utilized with complete success for many months past in motor vehicles of all descriptions.

"This fact, together with the experience which our associates in the recently formed International Hydrogenation Patents Company have already had in the production of 100,000 tons per year of petrol from brown coal and brown coal tar, which experience is now fully available to us, enables me to state that:—

"(1) Although high pressures and temperatures are used, our experience in the very similar technique of ammonia manufacture has enabled us to overcome satisfactorily all difficulties which have hitherto arisen.

"(2) The manufacture of hydrogen is a subject on which we have unique and extensive knowledge; neither the quantity required nor the price at which it can be produced presents any obstacle to the successful development of the hydrogenation process on an economic scale.

"(3) I am quite satisfied that it is now practicable to build in this country a plant for the production of petrol from bituminous coal. A plant to hydrogenate 1000 tons of clean, dry coal per day could produce No. 1 motor spirit and sell it at present standard retail prices with a small profit, after allowing for all costs of raw material, manufacture, repairs, obsolescence and distribution.

"It is not contended, however, that such a profit as the above would attract capital. It is mentioned as an indication of the fact that the hydrogenation process has already reached a stage at which only a very slight rise in the price of petrol is required to render it a self-supporting commercial proposition."

Yours faithfully,
H. McGOWAN (Chairman),
Imperial Chemical Industries, Ltd.
Millbank,
London, S.W.
August 10, 1931.

Coal-Tar Motor Fuel

THE Belfast (Ireland) Gas Works recently reported the perfection of a coal-tar oil product which is a satisfactory substitute for gasoline for use in internal combustion engines, according to information received at the Department of Commerce. It is said that the company can produce about 500,000 gallons of this substitute annually and that the cost of production is considerably less than the present price of gasoline in Ireland and England. Production costs are reported at eight cents per gallon.

A Belfast bus, running experiments with the fuel, ran 12 miles to the gallon as against eight miles per gallon with gasoline. No loss of engine power was reported, nor carbon monoxide in the exhaust, also it is claimed that the new fuel eliminates engine knocking.

Use of the new fuel necessitates some alterations in the motor and the engine must be operated for 50 to 100 yards on gasoline or benzol before it can be switched to the new fuel.

Properties of East Texas Crudes

The Bureau of Mines is distributing "Report of Investigations, No. 3130" "Properties of Typical Crude Oils from the East Texas Field," by E. L. Garton. This bulletin consists of the regulation Bureau of Mines distillation analysis of four samples from the East Texas field; namely, southwest extension Joiner, Joiner, Kilgore and Longview, and one sample from the Van field—all Woodbine sand crudes, with the East Texas crudes classified as intermediate base and the Van crude classified as paraffin base. Copies can be secured from the superintendent of documents, government printing office, Washington, D. C. at no cost.

▼ ASSOCIATION ACTIVITIES ▼

Interesting N. P. A. Program Announced

NATIONAL Petroleum Association has announced an interesting program including many timely subjects having to do with the technical and economic phases of the Petroleum industry. These addresses will be delivered at the three-day annual convention to be held at the Hotel Traymore, Atlantic City, N. J., September 16, 17, 18.

The annual banquet is to be held at the Traymore Hotel, Thursday evening, September 17, and Dr. E. J. Cattell will speak. The association advises its membership and visitors that hotel reservations should be made early because of other conventions in the city the same week. Following is the convention program:

Wednesday Afternoon, September 16

President's Address—E. M. Lyons.

"Progress in Aviation"—Jimmy Doolittle, Shell Petroleum Corporation.

"Refineries Outside of the United States"—C. J. Bauer, Standard Oil Company of New Jersey.

"Russia"—Col. George A. Burrell, Burrell-Mase Engineering Company.

Thursday Morning, September 17

"Oil Industry Economics," Joseph E. Pogue, petroleum economist.

"Something Appropriate—Depending Upon the Condition of the Industry at the Day, Hour and Minute of My Remarks," Henry L. Doherty, President Henry L. Doherty & Company.

"The Anti-Trust Laws and American Business," James a Emery, general counsel, National Association of Manufacturers.

Thursday Afternoon, September 17

Committee meetings including a round table conference on the lubricating oil situation.

Friday Morning, September 18

"Recent Developments in Refining," D. G. Brandt, Crew Levick Company.

"The Domestic Consumption of Lu-

bricating Oils," John D. Gill, Atlantic Refining Company.

"Coking Outside the Cracking Zone —Higher Yields of Gasoline, Higher Anti-Knock," Alfred Fisher, Universal Oil Products Company.

Chemical Society Papers of Value

DURING the eighty-second annual meeting of The American Chemical Society, held at Buffalo, New York, August 30 to September 4, a large number of interesting and valuable papers dealing with scientific progress of the petroleum industry were presented at the sessions of the division of petroleum chemistry. C. R. Wagner, chief chemist, Pure Oil Company, is chairman of the petroleum division, and C. D. Lowery, Jr., Universal Oil Products Company, is secretary. Of principal importance at this meeting was the two sessions devoted to a symposium on the utilization of gaseous hydrocarbons. The program follows:

Tuesday Morning

W. H. Bahlke and W. B. Kay. Physical and Thermal Properties of Petroleum Distillates.

J. C. Geniesse and Raymond Reuter. Reaction Velocity Constants of Oil Cracking.

J. H. Bruun and M. H. Hicks Bruun. Isolation and Determination of the Cyclohexane in a Mid-Continent Petroleum.

M. H. Hicks Bruun and J. H. Bruun. Isolation and Determination of the Methyl Cyclopentane in a Mid-Continent Petroleum.

J. D. White and F. W. Rose, Jr. Isolation of N-Nonane from a Mid-Continent Petroleum.

J. R. Bailey. The work of von Braun on Naphthenic Acids.

W. L. Badger and H. W. Diamond. Heat Transfer in Cast Iron Refinery Condenser Sections.

Tuesday Afternoon

Joint Meeting with Divisions of Industrial and Engineering Chemistry and Gas and Fuel Chemistry.

Symposium on "The Utilization of Gaseous Hydrocarbons."

D. B. Keyes. Introduction.

P. K. Frolich and P. J. Wiezevick. Refinery Gases.

E. G. de Coriolis and R. J. Cowan. Chemical Utilization of Natural and The Use of Hydrocarbon Gases for the Bright Annealing of Metals.

A. C. Fieldner, H. H. Storch, D. F. Smith and C. O. Hawk. The Conversion of Methane to Carbon Monoxide and Hydrogen.

C. G. Maier. Methane as a Metallurgical Reagent.

F. E. Frey and H. J. Hepp. Pyrolysis of Simple Paraffins to Produce Aromatic Oils.

S. C. Lind and G. R. Schultze. The Condensation of Hydrocarbons by Electrical Discharge.

Wednesday Morning

R. L. Moore. The Thermatomic Process for the Cracking of Gaseous Hydrocarbons.

C. H. Bibb. Partial Oxidation of Hydrocarbon Catalyzed by Oxides of Nitrogen.

S. P. Burke, C. F. Fryling and E. W. Schumann. Controlled Oxidation of Propane at High Pressures for the Production of Aldehydes and Alcohols.

J. R. Bates. Molecular Fragments and Oxidation Processes.

R. N. Pease. Homogeneous Gas Reactions of Hydrocarbons.

Wednesday Afternoon

Gustav Egloff, J. C. Morrell, C. D. Lowry, Jr., and C. G. Dryer. A Study of Inhibitors in Cracked Gasoline.

J. W. Ramsay. Gum Stability of Gasoline.

H. S. Davis and J. P. Daugherty. A Procedure for the Analysis of Hydrocarbon Gases.

Grease Discussion

M. H. Arveson. The Flow of Greases and Oils.

Ernest Zublin. Some Problems of Lubrication of Rocker Arms.

F. L. Koethen. Factors Influencing the Choice of Lubricants in Practice.

A. P. I. Meeting to Be Held at Lufkin

THE regular fall meeting of the Southwestern district of the American Petroleum Institute, division of production, will be held at Lufkin, Texas, in the Angelina Hotel, September 24 and 25. The program will be devoted to discussion of problems affecting drilling and producing in the East Texas fields, with papers dealing with fire prevention and safety in addition. It is planned to devote one of the sessions to a general discussion of proper and improper methods of drilling and producing in this area.

Gasoline Association Moves Headquarters

OFFICES of the Natural Gasoline Association of America have been moved from the Tulsa building to 819 Wright building, Tulsa. The association was one of the first to occupy space in the Tulsa building after its completion. Ray E. Miller, secretary of the association, is anxious to have records for mailing purposes changed by all those who have correspondence with the organization.

North Texas Refiners Association Formed

INDEPENDENT refiners in the North Texas district took preliminary steps toward the formation of an organization to be known as the North Texas Refiners' Association during a meeting held in Wichita Falls August 26. E. H. Eddleman, head of American Refining Properties, Inc., presided as chairman of the meeting. An organization committee consisting of Dave G. Gray, Dale Oil & Refining Company; Geo. Golden, Archer Refining Company; and R. G. Cocanower, Olney Oil & Refining Company, was appointed to draft a set of by-laws governing the policies and duties of the association.

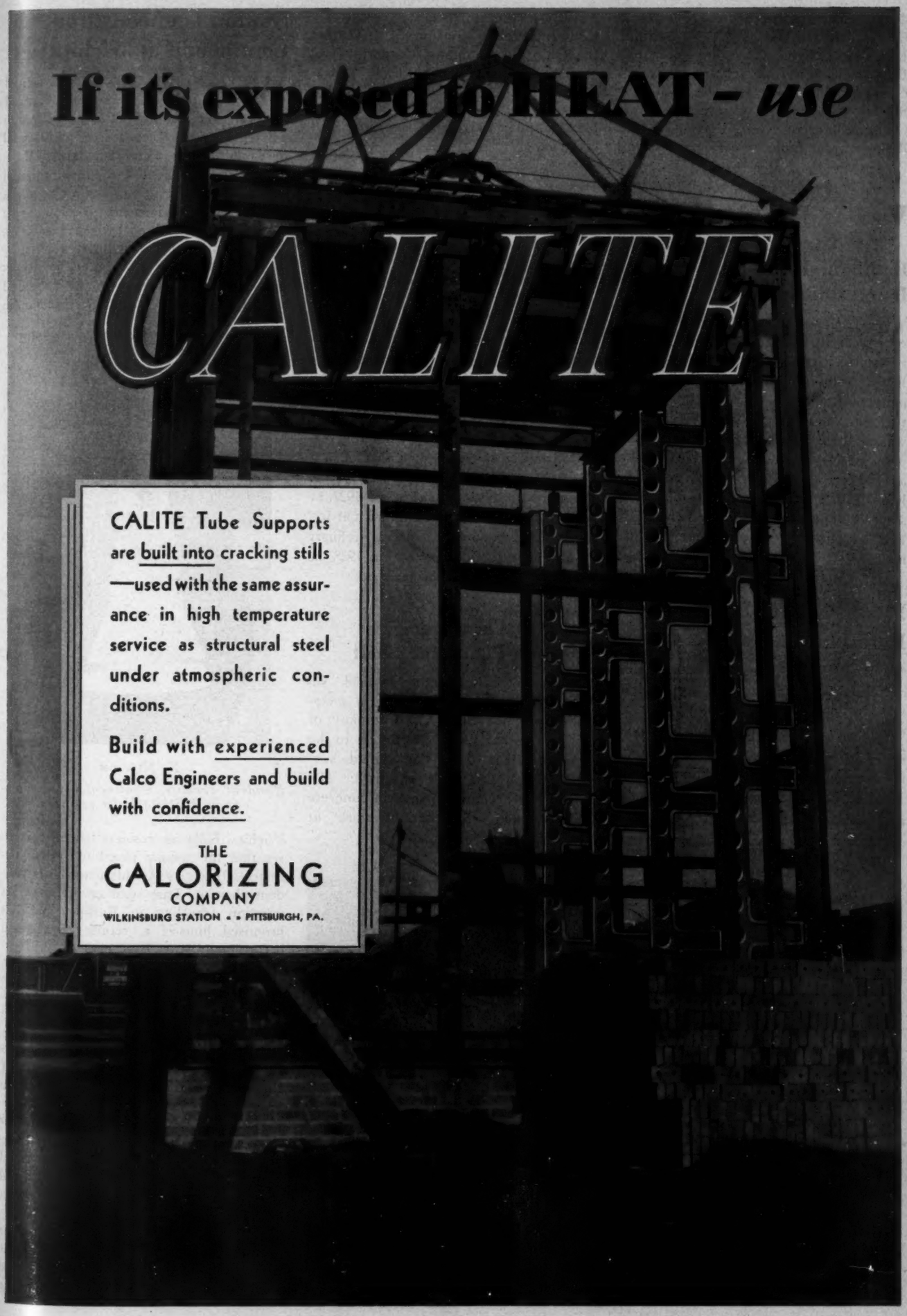
East Texas Refiners Form Association

EAST TEXAS Independent Refiners Association was formed in Dallas during the latter part of August, for the purpose of providing means of supplying crude and protection of marketing of the refiners interested. Eugene Constantin of Constantin Refining Company was elected president; G. L. Rowsey and Joe Danciger, vice-presidents, and E. F. Griswold, secretary and treasurer. All independent refineries are represented in the association. As a result of recent shut-down orders in the field all of these refiners face crude shortage.

Annual Safety Congress in October

THE National Safety Congress and Exposition will be held at Hotel Stevens Oct. 12 to 16, and the Petroleum Section of the National Safety Council will conduct a co-operative program dealing with ways and means of reducing accidents and accident costs in the petroleum industry, at three one-half day sessions and one luncheon session. A number of interesting and valuable papers will be read at these sessions.

The officers of the petroleum section are as follows: General Chairman, R. E. Donovan, Standard Oil Company of California, San Francisco; vice chairman, D. J. Wallace, Mid-Continent Petroleum Safety Council, Tulsa, Okla.; chairman, Atlantic division, E. R. Al-


If it's exposed to HEAT - use
CALITE
CALITE Tube Supports are built into cracking stills —used with the same assurance in high temperature service as structural steel under atmospheric conditions.
Build with experienced Calco Engineers and build with confidence.
THE CALORIZING COMPANY
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den, Vacuum Oil Company, New York City; chairman, Great Lakes division, J. C. Bernd, Sinclair Refining Company, East Chicago, Ind.; chairman, Mid-Continent division, H. W. Boggess, Sinclair Oil & Gas Company, Tulsa, Okla.; chairman, Gulf division, J. L. Risinger, Magnolia Petroleum Company, Beaumont, Tex.; chairman, Rocky Mountain division, D. J. Griffin, the Ohio Oil Company, Casper, Wyo.; chairman, Pacific division, C. P. Anderson, Richfield Oil Company, Los Angeles, Calif.; secretary, H. N. Blakeslee, American Petroleum Institute, Dallas, Tex.

▼ PERSONALS ▼

Rathbone Heads Baton Rouge Plant

M. J. RATHBONE, JR., has succeeded Louis Link, retired, as general superintendent of the Baton Rouge refinery of Standard Oil Company of Louisiana. "Jack Rathbone" is the son of M. J. Rathbone, Sr., who was in charge of Standard Oil Company of New Jersey's Camden Works at Parkersburg, West Virginia. Jack has been stationed at Baton Rouge since his graduation from Lehigh in 1921 with the degree of chemical engineer.

Pierce Guides Loreco's Refining Activities

R. B. PIERCE, refineries manager for Louisiana Oil Refining Corporation, was born near Boston, Massachusetts, and completed the grade and grammar schools in his native state. Afterwards, while attending the University of Maine, he majored in chemistry, receiving the degree of Bachelor of Science.

His first position after leaving the university was with American Writing Paper Company at Holyoke, Massachusetts, in the chemical department. At the outbreak of the World War, he enlisted in the infantry serving overseas with quite a colorful experience. Upon returning to the United States in 1919, and securing his discharge, he went with Beacon Oil Company at Everett, Massachusetts, starting down in the grades in the laboratory department. Working through that department, he went out in the refinery and through all the departments. In 1927 he became associated with Louisiana Oil Refining Corporation as general refinery superintendent. A year later, in 1928, he was made refineries manager.

Tulin in Charge of Gasoline Plants for Shell

R. S. TULIN, formerly field superintendent of gas and gasoline plants for Shell Oil Company of California, has been promoted to be superintendent of the department, succeeding A. M. Porter, resigned. Mr. Porter has become engaged in concrete building and construction work at Long Beach, California.

R. B. PIERCE
Refineries manager, Louisiana Oil Refining Corporation

Newton Is Chemist for Continental at Wichita

WHEN N. NEWTON was in school at Purdue University, he figured that when he was graduated in 1925 with a Bachelor of Science degree, as his goal he would enter some oil company's laboratory. At Florence, Colorado, Continental Oil Company had a plant, so they sent him there for a while. Then to give him some experience in handling hydrogen sulfides, they transferred him to Artesia. Here he had some real work in sweetening gasoline from that crude, and making it stand stability of color. His major problem in

N. NEWTON
Resident chemist, Continental Oil Company, Wichita Falls refinery

Wichita Falls as resident chemist is to see that the sodium plumbite system operates efficiently. At this plant he is resident chemist. Last summer he spent his vacation traveling in Europe, and has promised himself a return engagement before many years have passed.

Neal Is Chief Chemist at Wirt Franklin Refinery

HUGH A. NEAL entered the University of Oklahoma with the idea of becoming a chemist in petroleum, so when he graduated in 1927, he went with Empire Oil & Refining Company as their resident chemist to handle things at Okmulgee. But when Wirt Franklin needed a man to organize his laboratory and add other equipment at Ardmore, he went there.

We know he is not sleepy, but as the radio bug has bitten him, perhaps the short waves he likes so well has caused him to think with his eyes shut as in the

HUGH A. NEAL
He's a bug about Short Waves

picture. He is chief chemist for Wirt Franklin Petroleum Corporation, and when the superintendent is away from the plant, he assumes his duties in addition to making things operate in the laboratory.

General Superintendent Louis Link Retires

LOUIS LINK, formerly general superintendent of the Baton Rouge refinery of Standard Oil Company of Louisiana, and member of the board of directors, has retired after 43 years of uninterrupted service with his company. Mr. Link is a native of Bavaria. Entering the employ of the company in 1888, he started as a stillman, in the Kings County, New York, works of Stone & Fleming. The next step was Beaumont, then Bayway, and then Baton Rouge, where he became general superintendent in January, 1915. He is the inventor of several refining processes, and specialized in late years in the perfection of the Link cracking process.

Dr. Paulus Manager of Indiana Company Plants

DR. MAX G. PAULUS, formerly assistant general manager of all manufacturing activities of Standard Oil Company (of Indiana), has been appointed general manager, succeeding the late Dr. Gentry Cash, who died July 4.

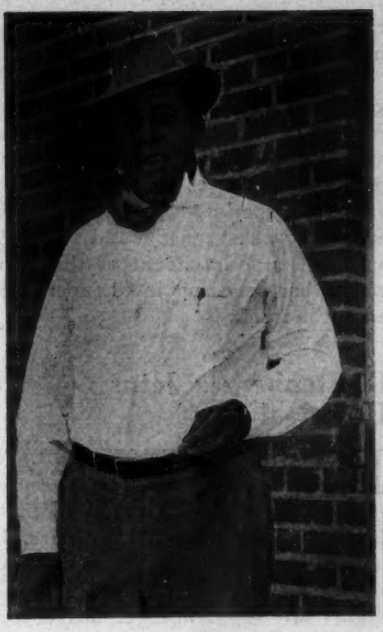
Harry F. Glair, formerly manager of the Whiting, Indiana, refinery has been made assistant general manager of manufacture. Dr. O. E. Bransky, formerly general superintendent of the Whiting works, has been promoted to manager, and Dr. E. J. Shaffer, formerly assistant general superintendent has been appointed general superintendent.

Rogers Likes East Texas Crude

E. L. ROGERS, refinery superintendent for East Texas Refining Company at Longview, Texas, says he would rather run sweet east Texas crude through his plant than sour New Mexico oil. Operating the refineries for Gilliland Oil Company at Roswell and at Albuquerque for that company, he was retained in the same capacity with Continental Oil Company when it purchased those plants.

During the World War he was overseas in the air service combat division, having had 5000 hours of combat flying without a scratch. However, he had the plane he was driving shot out of control a couple of times, but landed within his own lines in safety. While over there, he had two planes to his credit, and was decorated for it. A reserve officer in the air service, he must fly 10 hours in each year to maintain his status in the organization. That was not so difficult in New Mexico where he had the whole out of doors in which to fly, but, in East Texas he may wrap himself and plane around some of those Southern pine trees instead of a lone cactus. One has a hunch too that the climate of New Mexico is more to his liking than that where he is now located.

E. L. ROGERS
Likes East Texas oil, but prefers New Mexico to fly in



EARL C. ROFF
A fisherman who fell for golf

Roff Dismantles, Rebuilds and Operates

EARL C. ROFF began his refinery experience in 1917 with Roxana Petroleum Corporation in Cushing, Oklahoma. Transferred from that plant to Wood River, Illinois, he was made assistant superintendent of the "crackers" in 1923.

After several years of refinery operation, he associated himself with M. W. Kellogg Company, having a lot to do with the erection and operation of various installations that were erected by them.

Once a refinery operator, always one, so Taxman needed a man to overhall the old Miller plant in Wichita Falls. Securing Roff's services, the present company has seen the demolition of practically all of the old plant. The shell stills have been converted into storage, the bricks around them were broken up and used for driveways around the plant and walks near the equipment.

The present installation, Roff says can do everything but talk, running almost automatic. A fisherman by nature, he has turned to golf by inclination, making a hole in—well, let him tell it.

McCloskey Heads Imperial Refineries

L. C. McCLOSKEY, formerly general manager of Imperial Oil Refineries, Ltd., Toronto, Ontario, Canada, has been made president of the company, succeeding the late Charles R. Ewing. Some months ago Mr. McCloskey was elected to the directorate of his company. He has also been in

charge of manufacturing and purchasing.

Charles B. Leaver, for the past nine years superintendent of the company's refinery at Sarnia, Ontario, has been appointed general manager of the company. George L. Stewart, formerly assistant superintendent of the Regina, Saskatchewan, refinery, and since 1923 assistant superintendent of the Sarnia works, has been appointed superintendent at Sarnia.

Gerstenberger Joins Universal Staff

D. F. GERSTENBERGER, formerly in charge of refinery operation for the American Refining Properties, Wichita Falls, Texas, has joined the staff of Universal Oil Products Company, and has moved to Chicago. Mr. Gerstenberger has enjoyed wide experience in the construction and operation of cracking equipment. Prior to his connection at Wichita Falls, he was in charge of the Shreveport refineries of Louisiana Oil Refining Corporation. He started his refinery experience as a still fireman, at the Bayway, New Jersey, plant of Standard Oil Company of New Jersey in 1915. In 1919 he was made assistant general superintendent of the Charleston, West Virginia, plant, leaving there in 1923 to go to Louisiana Oil Refining Corporation.

T. C. Chestnut Dead

THOMAS C. CHESTNUT, founder of the natural gasoline company of Chestnut & Smith, died at his home in Tulsa in August following a protracted illness. Mr. Chestnut came to the Mid-Continent area in 1912. It was in June of that year that Chestnut & Smith Corporation was formed, other members being sons-in-law of Mr. Chestnut, T. K. Smith and Charles P. Quinlan.

For many years Chestnut & Smith Corporation was the outstanding manufacturer of natural gasoline in the Mid-Continent area. With the spread of oil development into Texas, plants were built there. Mr. Chestnut was one of the backers of technical research as applied to natural gasoline and Chestnut & Smith Corporation contributed generously to the work of the Natural Gasoline Association of America.

Employees Get Prize Money

THREE employees of Tide Water Oil Company, at its Bayonne New Jersey, refinery have been awarded the major prizes by the central suggestion committee which are awarded annually by the company for suggestions leading to improvement in equipment, or products, or tending to reduction of waste. Fred C. Burns of the machine shop, received $200 for suggestions to improve lubricating system on the Herreschoff earth burners at the filter plant. Michael Coughlin, Yard No. 1, received $150.00 for improved method of re-running off test and slop oils. Charles Northey, cracking coils, received $100 for suggestion for installation of overflow outlets at the cracking coils.

FRED DEERING

Deering Superintends Kanotex Operations

FRED DEERING has the distinction of having been born and reared in the town where he is now employed. Arkansas City, Kansas, having been the place of his nativity, is also the location of the refinery of Kanotex Refining Company. Fred worked and played his way through the grade and high school of the city, until in 1917, he matriculated in the engineering school of Kansas University at Lawrence. Completing only the first semester, he was appointed to the United States Naval Academy at Annapolis, Maryland.

After two years of sailor training, circumstances surrounding the death of his father, made it necessary for him to return to his home in Arkansas City. After his return, he secured a job with Kanotex Refining Company, placing him in a minor role as a refinery man—rather more prosaic, perhaps, than the position of a battle ship commander—should under a happier star he had been permitted to complete his studies at the naval school.

Nevertheless, due to perseverence, he made the grade through the different jobs around the plant, until in 1921, he was promoted to the position of plant night superintendent. After two years of nocturnal duties, he was promoted again, this time having the responsibility of the entire plant thrown upon him, with the title of refinery superintendent. Since then he has taken on paternal duties, having two boys aged three and two years, naming them Fred Junior and Tom.

▼ PLANT ACTIVITIES ▼

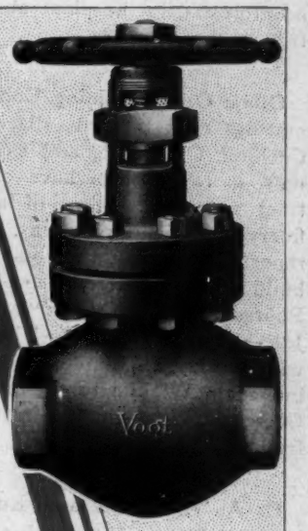
NEWS of the month continues to reflect the expansion of petroleum processing establishments, both in number of units and enlargement of existing facilities. In addition to the usual monthly quota of small refineries proposed or building, some major enterprises are reported. Fifteen new plants entered the operating list, and a dozen new refineries were announced. Merger news has been of importance throughout the month and it is evident that two of the larger proposed amalgamations may be successfully culminated in the early future. Two smaller mergings were successfully negotiated during the past month. Reports indicate that some few other long independent organizations may be acquired by financially stronger companies.

Producers experiencing difficulty in finding adequate crude oil outlet continue to install small refineries in various sections of the country, with Texas leading in the erection of such "tea-kettle" type refineries.

Several major refining companies with plans drawn for important expansion and enlargement schedules are still marking time before starting actual construction work, waiting until economic conditions have a turn for the better. Some operators in the East Texas field are making ready for the establishment of natural gasoline plants in that area of both compression and absorption type. Several refineries, however, are purchasing natural gasoline plant equipment for the purpose of pressure distillate stabilization and

product of Standard Oil *of* Ohio
Heat Tempered *at 1100 degrees*
Using Vogt drop forged steel valves *and* fittings

The Standard Oil Company of Ohio was fully justified in their selection of Vogt Drop Forged Steel Valves and Fittings to operate at 1100 degrees in the production of their new super motor fuel X-70.



Although the temperatures used in heat tempering SOHIO X-70 are higher than any employed to date in ordinary cracking processes, and the consequent need for valves and fittings of unfailing quality even more vital, no concern was felt for their safe operation. Absolute dependence can be placed in Vogt valves and fittings because they are designed with high safety factors and drop forged by skilled operators with experience in high pressure requirements.

You need not hesitate to specify Vogt drop forged steel when valves and fittings are required for operation at extremes of pressure and temperature.

Manufacturers of: Drop Forged Steel Valves and Fittings, Oil Refinery Equipment, Water Tube and Horizontal Return Tubular Boilers, Ice Making and Refrigerating Machinery, Heat Exchangers.

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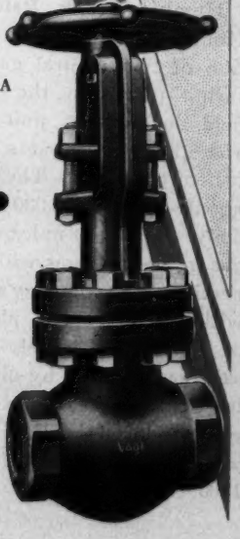

gasoline recovery and several of such units are now under construction.

NEW PLANTS

W. G. Davis Production and Refining Company, Venice, California, is reported planning erection of a 1200-barrel plant in the Playa Del Rey district. Wm. Landes will be manager of the refining department, while Mr. Davis will be in charge of development and production.

C. A. Edwards and associates of Louisville, Kentucky, are reported planning construction of a 250-barrel refinery at Evansville, Indiana. Santa Fe Oil Company of Tell City, Indiana, is interested in the plant and will distribute the products.

Globe Oil & Refining Company, operating refineries at Blackwell and Cushing, Oklahoma, and Lemont, Illinois, is reported to have closed contract for construction of a new refinery at Wichita, Kansas. The first reports stated that the company would build a 10,000-barrel plant near McPherson, Kansas. (Ref. & N. G. M., July, 1931, page 144). The company will also lay a 105-mile, eight inch pipe line from Wichita to the Ritz-Decker-Garrett area, and a six-inch pipe line from Wichita to Blackwell, Oklahoma.

C. A. Heartfield and Emmet Sedbury, of Shreveport, Louisiana, are reported proposing construction of a 1000-barrel skimming plant near Camps Switch on the Texas & Pacific Railroad in the Longview area of the East Texas field. C. A. Pears is to supervise construction work and superintend operation of the plant, which is scheduled for completion in October.

Humble Oil & Refining Company, Houston, has authorized the installation of two natural gasoline manufacturing plants in the East Texas oil field, including a unit in the Kilgore area that will process 10,000,000 cubic feet of gas daily. The other plant will handle about 4,000,000 cubic feet of gas daily. About 40 miles of miscellaneous gas gathering lines will be built in connecting the company's various leases with the above two plants, which will be constructed largely from equipment salvaged recently by dismantling plants in Central West Texas. Casinghead gas produced in East Texas offers a yield of more than four gallons per 1000 cubic feet.

Metropolitan Refineries, Ltd., has been incorporated to build a new refinery in the Los Angeles Basin territory. W. D. Rial, formerly manager of Richfield Oil Company's refinery at Watson (formerly Pan American Petroleum Corporation), is the head of the new company.

Mountain States Refining Company, composed of stockholders of Platte Valley Petroleum Company, owning production in the Greasewood field of Weld County, Colorado, is reported starting construction of a 200-barrel skimming plant at Orchard, Colorado. E. E. Calkins is president of the company, A. E. Shogren, vice president, S. D. Markley, secretary and E. G. Markley, treasurer.

Nicholson Refining Company, recently organized at Long Beach, California, reports that it will build a new refinery at Pine and Spring Streets, Long Beach. T. T. Nicholson is president and other incorporating directors are B. M. Stits and J. L. Telegdi, also of Long Beach.

Shell Petroleum Corporation is again reported planning construction of an Eastern Seaboard refinery, probably at Bayonne, New Jersey, where Standard Oil Company of New Jersey, Gulf Refining Company, and Tide Water Oil Company are operating large plants. This proposal has been in the news occasionally for the past year or so but no definite confirmation has been available.

Sinclair Refining Company started construction work early in August in re-building the large obsolete skimming plat at Fort Worth, Texas, that was acquired along with other properties from Pierce Petroleum Corporation in June, 1930. The present owners of the Fort Worth plant are rehabilitating same by transferring equipment from its 10,000-barrel skimming plant at Cushing, Oklahoma, and will probably provide facilities for processing about 5000 barrels of crude daily. The Cushing plant had been leased to Globe Oil & Refining Company. East Texas crude will be used by Sinclair Refining Company in the Fort Worth plant, which is expected to go into operation when reduced railroad freight rates out of Fort Worth become effective October 16.

Stanolind Oil & Gas Company, Marine Corporation, Magnolia Petroleum Company and Phillips Petroleum Company are reported planning establishment of natural gasoline extraction plants in the East Texas field. Humble Oil & Refining Company is already building two gasoline plants of compression type. The natural gas is reported to have an average gasoline content of three to five gallons per thousand cubic feet, with such averages holding good through all sections of the producing territory.

Sterling Oil Refineries, Ltd., has been incorporated under Dominion charter with headquarters at Moose Jaw, Saskatchewan, Canada. The company proposes the construction and operation of a refinery at Moose Jaw (Ref. & N. G. M., August, 1931, page 32, reports $125,000 expenditure).

K. T. Weidmann, head of a marketing concern in Minneapolis, is reported investigating prospects for locating a 2000-barrel refinery in East Texas to supply a chain of stations in Minneapolis.

OPERATING

Constantin Refining Company, Dallas, began operating its 2500-barrel capacity skimming plant, located a short distance southeast of Overton and on the I&GN Railroad, late in August. (Ref. & N. G .M., August, 1931, page 131).

Concho Refining Company, San Angelo, Texas, made initial crude runs middle August on its 300-barrel daily capacity skimming plant located on the Santa Fe Railroad on the northeast edge of San Angelo. Crude is obtained by tank cars from high gravity oil pools in Irion and Coleman Counties. The officers of the company follow: Joe Sanger, president; R. D. Lavery, vice-president; and Harry J. Earls, secretary-treasurer.

Echotex Refining Company, owner of a 300-barrel daily capacity skimming plant at Echo, Texas, made its initial runs middle August. Crude supply for this plant will be obtained from shallow high gravity oil producers in Coleman County, with deliveries being made by trucks.

Glade-Tex Refining Company, Gladewater, Texas, completed construction work on its 750-barrel daily capacity skimming plant, which is located at Gladewater and within the productive limits of the East Texas oil field about

advantage of these low costs in buying material for the construction of Dubbs units—without profit to Universal

Gasoline prices will surely go up Cracked gasoline brings the best price even today

The refiner with the latest Dubbs cracking plant, built at lowest cost, is sitting pretty

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor

the time that the field was completely shut in by martial law. The plant was shut down for crude after making trial runs, but has arranged for a portion of its crude requirements when the field is restored to production on a proration basis. The company is incorporated under the laws of Texas and is owned by H. L. Lockhart of El Paso, and Walter K. Campbell of Wichita Falls, Texas. J. D. Goulett, Gladewater, is superintendent of the refinery. The plant is located on the Texas and Pacific Railroad.

Goshen Oil Refining Company has started operating its refinery at Torrington, Wyoming, processing Osage and Lance Creek crude, having a rated capacity of 300 barrels daily. The management is reported considering erection of a small cracking unit. M. E. Eaton is president and general manager. E. D. Bishop is in charge of refinery operation.

Hylow Refining Company, Piru, California, has placed its recently completed lubricating oil refinery in operation, processing heavy crude from the Hadley wells in Sespe Canyon.

Indian State Oil Company of Texas, which maintains headquarters on the third floor Allen building, Dallas, placed in operation late August a 1000-barrel capacity skimming plant located within the productive limits of the East Texas field at Gladewater. V. O. E. Wright is superintendent of the plant. The company has a chain of retail stations in Dallas, and proposes to erect small plants in the near future at Paris and Ennis, Texas.

Malco Refineries, Inc., Artesia, New Mexico, has begun operating its 1500-barrel refinery, processing Artesia crude. The plant includes pipe still distillation and bubble type fractionating equipment erected by Southwestern Engineering Company. M. E. Barst, Artesia, is president and general manager of the company; R. E. Shingart is secretary and treasurer; L. R. Simon, plant superintendent, and Robert Halley, manager of bulk and service stations. The refinery is located on the Santa Fe Railroad. (Ref. & N. G. M., July, 1931, page 145).

Mid-Texas Petroleum Corporation, Oklahoma City, is scheduled to begin operating early in September a 250-barrel capacity skimming plant, located near Eliasville, Texas, and it will be supplied with crude from the company's deep wells on the Cunningham and Donnell leases, South Young County.

Norgold Refining Company has started operating its 300-barrel skimming plant near Olney, Texas. N. D. Goldsmith is president of the company, J. P. McGee is vice president and superintendent of the plant, and A. T. Gray is secretary and treasurer and in charge of sales. (Ref. & N. G. M., June, 1931, page 147).

Ultra-Penn Refining Company, recently organized company taking over the refinery of Butler County Oil Refining Company, is now operating its 1000-barrel complete refinery at Butler, Pennsylvania. Harold C. Eaton is president and general manager of the new company; H. H. Phillips and Myron Evans are vice presidents and F. C. Dodds, secretary and treasurer. Myron Evans is manager of tank car sales and Earl Zinn is in charge of bulk and service stations. William G. Wagner is refinery superintendent. (Ref. & N. G. M., July, 1931, page 151).

The Pennsylvania Refining Company, Titusville, Pennsylvania, has resumed operation of its 1000-barrel complete refinery as a result of improved market for refined products, especially lubricating oils. The company also operates a 1500-barrel plant at Karns City, Pennsylvania.

Petroleum Refractionating Corporation is the name to be used by Danciger Oil & Refining Company, Fort Worth, Texas, in operating the 10,000-barrel daily capacity skimmnig plant previously reported as having been started by the latter concern in East Texas. The former concern is owned entirely by the Danciger interests, and is operating a plant at Pampa, Texas. The East Texas plant is located on the I&GN Railroad between Longview and Kilgore, and is scheduled to be completed about October 1. Longview Pipe Line Company, another subsidiary of the Danciger interests, has completed a net work of crude gathering lines in East Texas to supply the above plant. Two 55,000 barrel tanks are being erected at the refinery site.

Republic Oil Refining Company, with operating headquarters at 609 Second National Bank building, Houston, Texas, started operating its new 5000-barrel skimming and cracking plant at Texas City, early in August. The skimming unit, erected by Struthers-Wells Company, and being designed by that company, and D. W. Hovey, vice president and general manager of the concern, was first to begin operations. Construction work on the Winkler-Koch type cracking unit of 3500 barrels capacity, is still under way with completion scheduled for early in October. Completion of all auxiliary equipment is virtually accomplished. L. M. McKinney is plant superintendent. The plant operates on Big Lake, Reagan County and East Texas crudes. Texas Pipe Line Company serves the refinery. (Ref. & N. G. M., Jan., 1931, page 60, also, April, 1931, page 194).

It is reported that the company contemplates the erection of a complete lubricating oil plant to operate in conjunction with present facilities.

Executive offices of the company are in the Benedum Trees Building, Pittsburgh. O. D. Robinson, formerly an official with Transcontinental Oil Company, is president; D. W. Hovey, former vice president, Waverly Oil Works Company, is vice president and general manager; J. O. Corner is vice president; Otto Massey, secretary, and W. H. Moreland is treasurer. H. T. Hoffmaster, Jr., with headquarters in Houston, is salesmanager.

▼ CHANGES ▼

Canada Oil Producers, Petrolea, Ontario, Canada, has sold its refinery at 21 Highway St. to M. L. Volway of Petrolea. The new owner plans complete remodeling and the installation of some new equipment, according to a recent item appearing in Chemical & Metallurgical Engineering.

Coastal Petroleum Company, Mobile, Alabama, awarded contract September 2 to the J. P. Devine Manufacturing Company, Inc., Mt. Vernon, Ill., for the immediate construction of a 5000-barrel capacity crude refinery to be located at Mobile. John T. Cochrane, president of the Alabama, Tennessee & Northern Railroad, is sponsoring this refinery project, which will be located on the above railroad as well as being the first major enterprise to be erected on a newly created industrial section bordering on deep water facilities near Mobile. Vic H. Smith of Tulsa, who has been identified with a number of refining projects in the Mid-Continent district in the past, is to be general manager of the company, with the capital stock of the company controlled by the above two parties. The refinery is expected to cost about $180,000, including site, trackage and docks. It is planned to erect three 55,000 barrel steel tanks for storage. East Texas

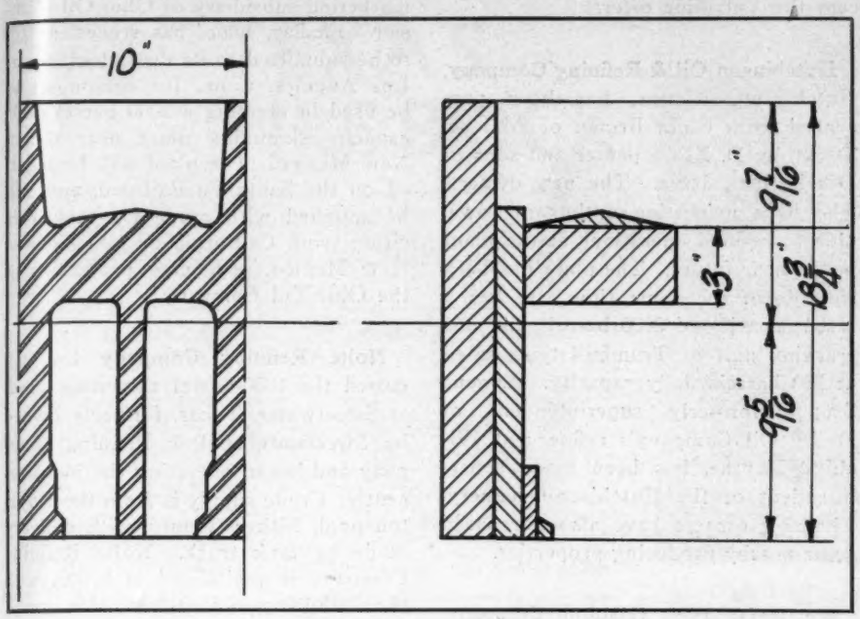

Fig. 3. Leach channel considered as structural member. Extreme fibres carrying load are protected from corrosion.

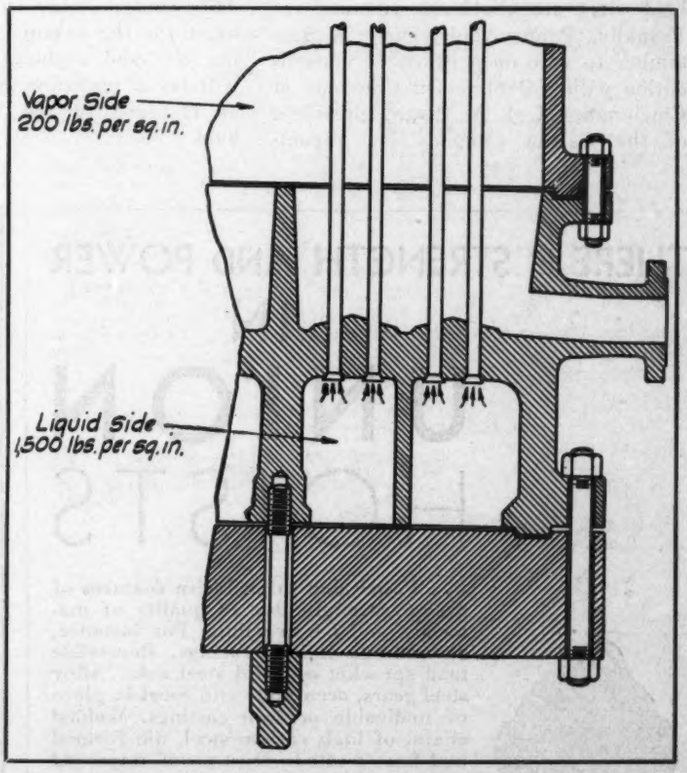

Fig. 2. Cross section of Leach channel. Notice that the tube sheet is of moderate thickness permitting easy rolling or removal of tubes.

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crude is to be used in the Mobile plant, with deliveries taking place via pipe line to the Texas Gulf Coast, thence via tankers to the plant.

Cosmopolitan Oil Company has been organized by a number of companies refining and marketing in California for the purpose of purchase and distribution of gasoline. The new company hopes to have a stabilizing effect upon the California market conditions through the purchase of gasoline. The companies owning stock in the new organization are, Rio Grande Oil Company, Hancock Oil Company, MacMillan Petroleum Company, Signal Oil & Gas Company, and Western Oil & Refining Company. Directors include, S. B. Mosher, A. W. Taylor, L. M. Lockhart, C. S. Jones, Geo. D. Williams, R. S. MacMillan and H. R. MacMillan.

Galena Signal Corporation (originally Galena Signal Oil Company), held its stockholders meeting at Franklin, Pennsylvania, early in September to vote on a proposed consolidation with Valvoline Oil Company at Cincinnati. M. J. A. Bertin, president of the Galena company has recommended to stockholders that they accept the Valvoline offer.

Hutchinson Oil & Refining Company, Hutchinson, Kansas, has been purchased from C. L. Brown of Abilene, Texas, by D. E. Carpenter and sons of Des Moines, Iowa. The new owners, who have marketing outlets in Iowa, plan to resume operations at the plant in the near future. The plant has been shut down for some time. It has a rated capacity of 2000 barrels and one cracking unit of Trumbull type, rated at 750 barrels daily capacity. Eugene Sapp, formerly superintendent of Derby Oil Company's refinery at Wichita, Kansas, has been made superintendent of the Hutchinson refinery. The new owners have also purchased some nearby producing properties.

Kettleman Hills Gasoline Company, Hanford, California, plans to increase capacity of its refinery to 3000 barrels daily, and possibly will include equipment for the manufacture of lubricating oils and asphalts. The company will lay a pipe line from the refinery at Hanford to the Kettleman Hills field.

Marathon Oil Company, refining and marketing subsidiary of Ohio Oil Company, Findlay, Ohio, has requested bids to be submitted to its district offices at Los Angeles, Calif., for equipment to be used in erecting a 2000 barrel daily capacity skimming plant near Grant, New Mexico. The plant will be located on the Santa Fe Railroad, and will be supplied with crude via tank cars either from California or Lea County, New Mexico, producing properties of the Ohio Oil Company.

Nolte Refining Company has acquired the 1000-barrel skimming plant at Sweetwater, Texas, formerly owned by Sweetwater Oil & Refining Company and began operating the plant recently. Crude supply is from the Royston pool, Fisher County, with delivery made by tank truck. Nolte Refining Company is capitalized at $5000, with the following officers, W. M. Jones, president; C. H. Nolte, vice president,

Producers & Refiners, Ltd., are now occupying the site of the old Exeter Oil Company natural gasoline plant in the Torrance, California, field, on Carson Street, with a new 8000-barrel skimming plant. This plant was erect-

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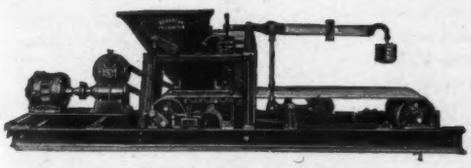

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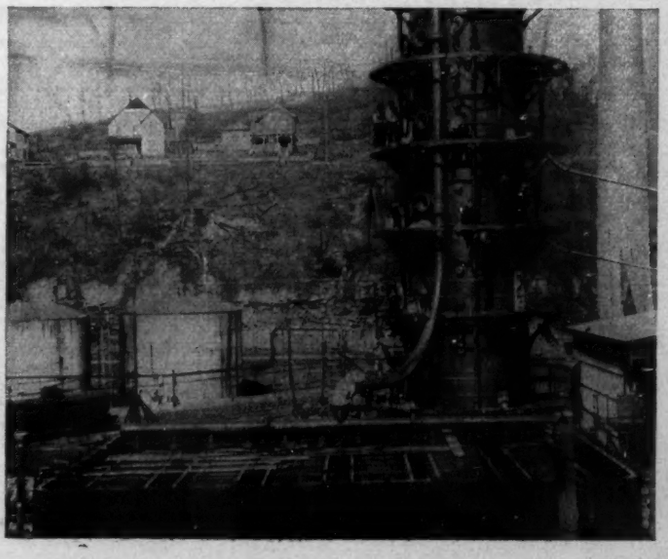

ed by Technical Engineering Company, with T. H. Clements in charge. The former equipment used by Exeter Oil Company is to be dismantled. The directors of the new company are G. M. Skidmore, W. E. Entrikin, J. H. Clements and J. E. Kelby.

Richardson Refining Company, which maintains headquarters at Fort Worth, Texas, with a 7500-barrel daily capacity skimming and cracking plant at Big Spring, Texas, was placed in voluntary receivership through a petition filed August 25 in the Federal District Court at Fort Worth. W. D. Richardson is president of the company, and a large stock interest in the company was held by Cosden Oil Company, which has been operating under a receivership since November 10, 1930.

Roeser - Pendleton, Inc., Arkansas Fuel Company (Cities Service) and Yount-Lee Oil Company, jointly are reported planning construction of a large natural gasoline plant in the Longview area of the East Texas field. Gas is to be purchased from owning company properties and adjoining producers, and plans include the repressuring of the Woodbine formation with residue gas.

Sinclair Refining Company, at its Houston refinery has practically completed its $4,000,000 expansion program begun last year. Additional equipment installed gives the plant a possible crude oil processing capacity of 70,000 barrels daily. Included in the construction was a new treating plant, three De-Florez tube stills for cracking service, a Badger tube still, a Foster-Wheeler stabilization plant, Braun cooling tower, new pump house, and additional storage facilities and power plant units. With the new equipment in service some of the older stills will be dismantled. The company is preparing to modernize its Fort Worth plant, acquired last year from Pierce Petroleum Corporation and which has been idle for about ten years.

Standard Oil Company of California is participating in the reorganization of California Spray Chemical Company, manufacturers of sprays consisting principally of mineral oils. The new company will be styled California Spray Chemical Corporation. E. E. Luther is president and general manager. W. H. Volck is in charge of the technical staff. Both have been engaged in the development of insecticides for the past 25 years. The original company was organized in 1908 and its business has increased rapidly, especially in the distribution of sprays in the Pacific Coast territory with later development of foreign markets. In addition to the two mentioned above the board of directors consists of K. R. Kingsbury, R. K. Davies, G. E. Kennedy, B. W. Letcher, P. P. Matt, R. F. Vickery and P. A. Sinsheimer.

Standard Oil Company of New Jersey and Standard Oil Company of California officials, late in August, met at Lake Tahoe, California, to discuss the proposed merger of the two companies into a $2,400,000,000 concern. K. R. Kingsbury, president of the California company and Walter C. Teagle, president of the New Jersey company and other officials and associates were present at the meeting seeking a suitable plan. An official statement by Standard Oil Company of California states, "Resuming discussions tentatively initiated more than two years ago, W. C. Teagle and K. R. Kingsbury and certain associates are meeting at Lake Tahoe, California. The purpose of the meeting is to consider whether a mutually acceptable plan for the merger or consolidation of the two companies can be reached."

Standard Oil Company of Ohio has reached an agreement with Solar Refining Company, Lima, Ohio, whereby the former will acquire the latter. Both companies were subsidiaries of the old Standard Oil Company. The consolidation is subject to ratification by stockholders, which is said to be assured. Solar stockholders are to meet October 1 to vote on the merger. Solar Refining Company has an 18,000-barrel complete plant at Lima, equipped with Cross and Burton cracking processes and one unit classified as "own." Acquisition of the Solar refinery will bring the Ohio company's refining capacity to 60,000 barrels daily, with refineries now operating at Cleveland, Toledo, and Latonia, Kentucky.

United Refining Company, Warren, Pennsylvania, has completed construction of a reforming unit designed for the reforming of naphtha to produce gasoline of high anti-knock value. The unit was erected by Struthers-Wells Company. A unit of Gray vapor phase treating process has been erected for treating the gasoline.

Australian Imperial Shale Oil Company, Wingello House, Angel Place, off 129 Pitt Street, Sidney, Australia, has established a plant at Mudgee in the Western District of New South Wales, for the production of crude oil from shale. The company reports that it is contemplating the erection of a refinery at the same location within the near future.

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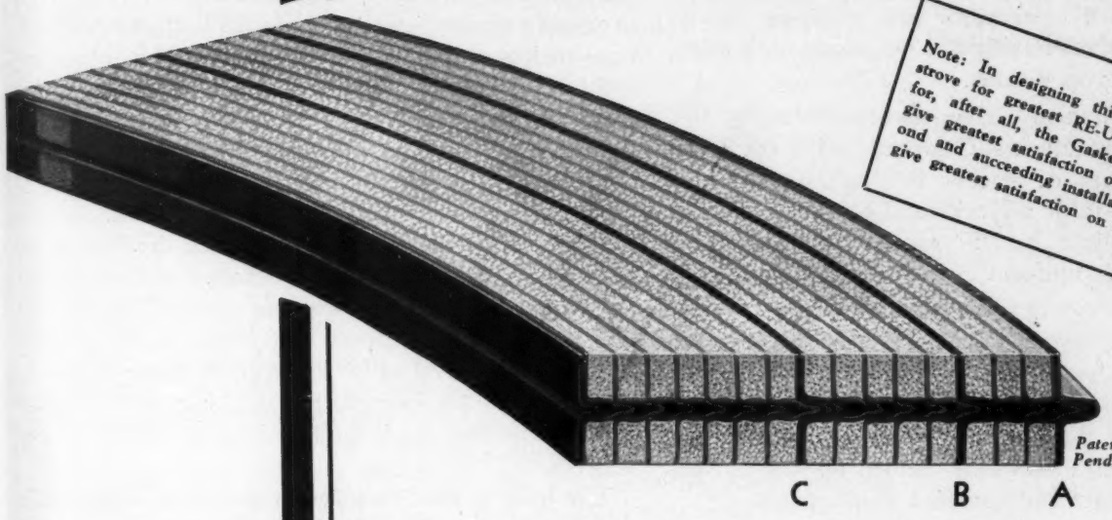

Patent Pending

Note: In designing this Gasket we strove for greatest RE-USABILITY, for, after all, the Gasket that can give greatest satisfaction on the second and succeeding installations will give greatest satisfaction on the first!

In making this man-hole Gasket, we have added to, we have not taken from, the basic principles of Flexitallic construction. We took a Gasket that had already built up for us a thriving business, and bettered it, gave it even greater strength, even longer life.

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In addition to the regular, soldered, double-thickness end-off at the outside (A), we've placed another completely soldered end-off a few plies inside (B). Just get the significance of that! For reuse, you have practically two Flexitallic Gaskets in one. If the final end-off, after service, shows any signs of wear whatever, the outside plies can be removed in a moment. You still have another spotless end-off; your Gasket is still intact with ample bearing surface; you can put it back in service with the same confidence as with the original installation of the brand-new Gasket.

Besides the additional end-off we've a double-thickness metal reinforcement at the center (C). This reinforcement is clinched. It makes doubly certain that the Gasket won't "spread" under pressure. It reduces strain on the outer plies of metal. You will recognize its importance at a glance.

How a Flexitallic Gasket Is Made

First the right metal, in strip form, is selected for the job that the finished Gasket is to do . . . steel, stainless steel, copper, Monel, aluminum or whatever is best. A special device on the gasket-winding machine then puts a V-shaped, spring-like crease lengthwise in the strip. Two strips of the finest asbestos ribbon are fed, one on each side of the crease. All three strips are wound in one operation until the gasket has the right number of plies.

In winding, the V-shaped crease in each ply locks with the crease in the ply next to it. The asbestos nestles in its place between metal; a tight, yet flexible spiral, 19 PLIES to EACH INCH, is the result.

Now, we have added double thicknesses of metal at 4 places, with TWO outside end-offs completely clinched and soldered.

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The V-shaped metal, in service, pushes against the squeeze, making a Flexitallic seal tighter, even with less pull-down. Flexitallic Gaskets are *alive;* after release they have a comeback of 30-40%. They pay for themselves: no follow-up, no cleaning or chipping of plates or headers. Add these advantages to reusability; you have utmost economy.

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Short Center Drive for Oil Field and Refinery Machinery

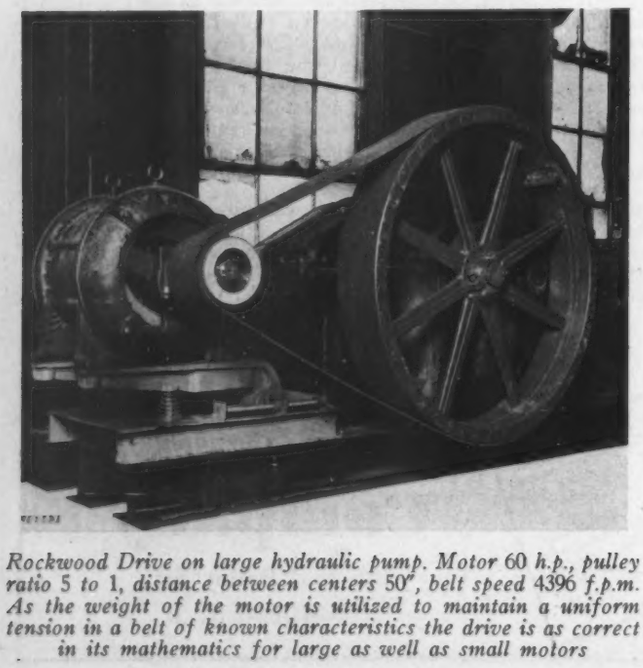
By J. H. WILLIAMS
Engineer, Chicago Belting Company

THERE is a new short center drive using flat belting and flat pulleys that has many characteristics which make it worthy of consideration both for standard compressor and pumping drives as well as for drives having the notorious high overloads on drilling operations.

It is the Rockwood Drive, manufactured by the Rockwood Manufacturing Company, with the leading manufacturers of leather belting co-operating. The drive consists of a Rockwood base, one or two paper motor pulleys, and a special water-proof flat leather belt of uniform construction and high capacity.

The motor is mounted on two arms or brackets which are in turn mounted onto a pivoted shaft anchored on two adjustable screws in the base. Part of the weight of the motor is utilized to maintain a prescribed tension in the belt—which tension is thus maintained uniform and constant at all speeds.

As the co-efficient of friction of a leather belt of high capacity operating over a paper pulley is very high, the drive operates with a ratio of 9 to 1 between the tight and loose side. As the tension is maintained uniform at all speeds, the belt operates under what approximates ideal conditions, as about all the factors which have limited the life of or caused trouble in belt transmission can be traceable in some way to lack of maintenance of uniform tension.



Rockwood Drive on large hydraulic pump. Motor 60 h.p., pulley ratio 5 to 1, distance between centers 50", belt speed 4396 f.p.m. As the weight of the motor is utilized to maintain a uniform tension in a belt of known characteristics the drive is as correct in its mathematics for large as well as small motors

In all band transmission—with either flat or V shaped belts—the belt lengths change with speed changes due to centrifugal force. In this drive the center distance automatically changes with the changing belt lengths—so the tension in the belt is always uniform. It is the only short center drive where the center distance is not fixed.

Each drive is designed to have an overload capacity of 150 per cent of the motor rating for standard drives, and for heavy duty drives in field work the overload capacities are much higher. This high overload capacity—which is unique with leather belting—makes possible a much longer belt life than with fixed center drives — a belt life with any belting material estimated by engineers in the leather belting industry to be about double that otherwise secured.

As the action of the motor on the pivoted base automatically takes up all belt stretch the belt never has to be touched after it is installed and never has to be cut or shortened. Buying leather belting the belt can be made endless—doing away with all bolts and metal fastened ends. The center distance can be short as may be desired, just as long as the arc of contact on the small pulley is not less than 130 degrees.

The base is used in place of the usual motor rails and is bolted to the foundation. The weight of the motor is engineered to give just the right tension in the belt and this tension is never so high as to shorten the life of the belt or increase the pressure on the motor bearings. In fact the low pressures on the motor bearings are outstanding features.

Advantages claimed for the drive are higher efficiency, much longer belt life without attention, space saving of short centers, high overload capacity, pronounced ability to handle jerk and shock loads, lower operating and maintenance costs, and lower power consumption.

The efficiency is 99 per cent and higher and this efficiency does not decrease with use. The driven pulleys are maintained at accurate driven speeds under load. When installing the motor can be aligned quickly by a few turns of a wrench on the adjusting screws and the motor can be moved back for additional belt take-up by means of these same screws.

Another interesting feature of this drive is that with tension maintenance the leather belt can operate at much higher speeds. Heretofore the approximate speed limit of leather belts has been placed conservatively around 5000 f.p.m. whereas on the Rockwood Drive the speed can operate successfully as high as 7000 feet per minute.

The belts are all in accord with the A.P.I. specification for leather belts—with added uniformity and increased standardization attempted.

New Equipment for the Modern Plant

Flow Instruments

TAGLIABUE MANUFACTURING COMPANY

C. J. Tagliabue Manufacturing Company, Brooklyn, announces a line of flow instruments completely described in catalog No. 1020. These new instruments include TAG Flow Recorder - Controller for Liquids, TAG Flow Meters and TAG Orifice Meters for Gases, TAG Flow Recorder - Controllers for Gases and TAG Liquid Level Recorder-Controllers.

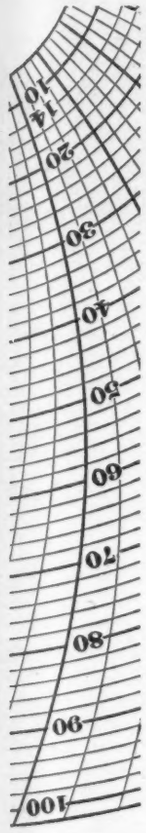


FIGURE 1

There has been an active need for flow controllers that will do more than simply record differential pressure with the use of progressive charts for the rate of flow. Although an instrument may function satisfactorily within its allowable tolerance, at the higher rates of flow, it is particularly important that inaccuracies do not increase at medium and low rates of flow to the same extent that the graduations are compressed.

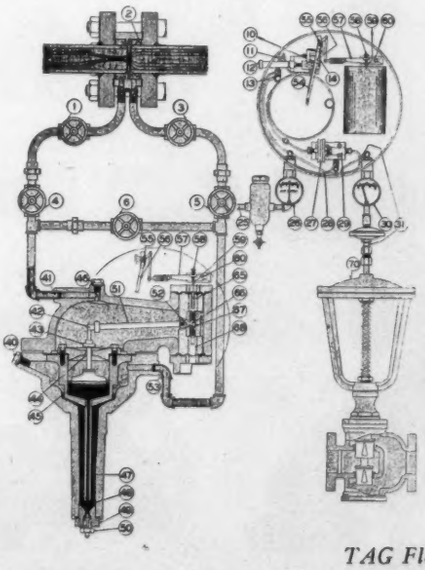
Control work, particularly, demands good accuracy for any rate of flow and this can be accomplished by the use of a chart reading directly in rate of flow but uniformly graduated, like the one shown in Figure 1. This uniformity of graduations is made possible by the special design of the differential pressure gage—one leg of the manometer being made progressively smaller in diameter so that the curved cross-section of this leg produces uniform rise and fall of the mercury in the other leg and uniform motion of the float per increment of change in rate of flow.

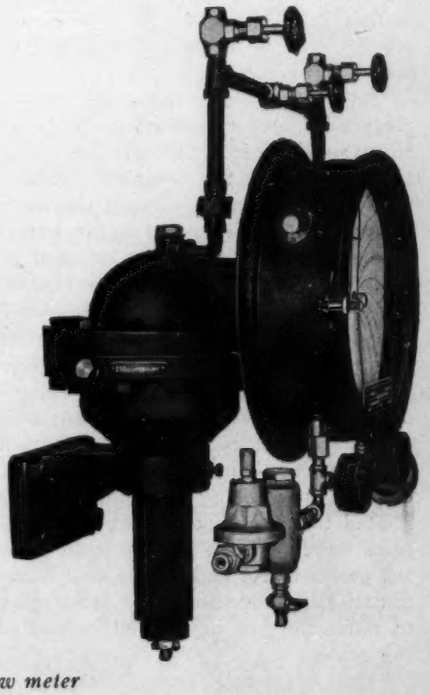
Among other noteworthy features is the method whereby a pressure tight bearing is eliminated in transmitting the float movement from inside of the manometer pressure-chamber which is at pipe line pressure to the recording pen outside which is under atmospheric pressure without friction or leakage.

The lever 51, which transmits the vertical movement of the float, engages yoke 67. This yoke is supported in position by two bellows 65 and 68, one at each end. These bellows being identical are equally affected by pressure changes inside or outside the pressure chamber and balance each other so that such pressure changes can cause no movement of this yoke. At the same time they allow the yoke to move without any restriction up or down as the float falls and rises. The yoke extends through the inside of the upper bellows, 65, enabling its motion to be communicated to the pen leverage system by pin 59. This construction eliminates friction and avoids any opening through the pressure chamber which is sealed from the atmosphere. A mercury blow-out check is provided by the top of float 45 and the bottom of disc 43 which closes passage 44 at the limits of normal float travel. It acts automatically to prevent blowing out of the mercury in the differential pressure gage should there be a sudden surge or an accidental disconnection of one of the orifice pressure lines.

The TAG balancing control feature is incorporated as standard equipment and insures full-floating action of the diaphragm valve and entirely eliminates over-control tendencies and "hunting." This development furnishes 100 per cent automatic control by its ability to maintain the diaphragm valve opening at the required demand point over the full range of valve opening. It also permits the operator to change the setting point anywhere within the range of the controller without fear that the controller will "go into a swing." The balancing feature enables the controller to quickly and smoothly change the diaphragm valve opening to the new demand point—and hold it there without "hunting."

C. J. TAGliabue Manufacturing Company will send upon request its new catalog No. 1020 fully describing the line of new TAG Flow Instruments.





TAG Flow meter

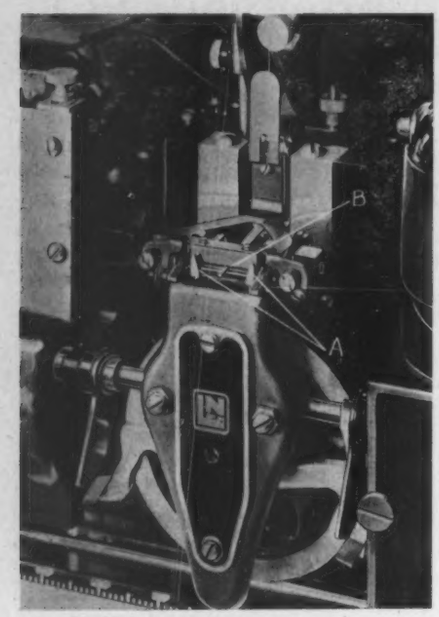
Potentiometer Pyrometer

LEEDS AND NORTHRUP

Leeds and Northrup, Philadelphia, has placed on the market an improved potentiometer pyrometer called the "Micromax." Announcements of this improved instrument describe it as climaxing over 20 years of specialized building of potentiometer pyrometers, combined with three years' concentration on the proving of Micromax features.

"The Micromax pyrometer constitutes a major contribution to accurate, reliable measurement and control of industrial temperatures," states an official of the Leeds & Northrup Company. "It is more sensitive, more rugged, and is faster in operation. It is fully automatic and eliminates daily attention and adjustments. These advantages are obtained by the new mechanical balancing device, and the automatic standardizer, which checks the

NEW EQUIPMENT FOR THE MODERN PLANT



Close-up of the Micromax Balancing Unit, showing scissor levers (a) open. They close on the Galvanometer Pointer (b) without clearance. Greater sensitivity is secured with greater ruggedness. The device is remarkably simple and with the self-standardizer, raises the operation of the Potentiometer Pyrometer to a new level of dependability and accuracy—by bringing mechanical operation up to the very high level of the electrical operation and by removing the human factor from the temperature measurement

instrument circuit every 45 minutes or less. In accordance with our policy, it was desired to protect the many present users of L. & N. Potentiometer Pyrometers, and this has been achieved in that L. & N. Recorders now in operation may be equipped with Micromax improvements.

"The Micromax balancing device gives micrometer sensitivity, needs no adjustment and is remarkably fast-acting. Due to the complete elimination of operating clearance between galvanometer pointer and levers, pointer deflections as small as 1/1000th of an inch can be detected and recorded. Because of this ability of the balancing device to detect extremely small pointer movements, Micromax gives greater sensitivity with greater ruggedness. The recording pen can step across the entire 9⅞" of calibrated chart in less than 22 seconds, the size of each step being far more closely related to the extent of pointer deflection. The non-slip driving clutch for the pen is direct and simple, and is automatically prevented from attempting to move the pen beyond either end of the scale.

"The automatic standardizer is a simple device which automatically checks the potentiometer circuit every 45 minutes or less, giving a much closer adjustment than is obtained by hand. Also, the circuit can be standardized at will (as after changing a thermocouple, when a check is desired) before the 45-minute cycle is completed. By means of the automatic standardizing, the machine itself assures potentiometer accuracy, and the memory of an operator need not be depended upon."

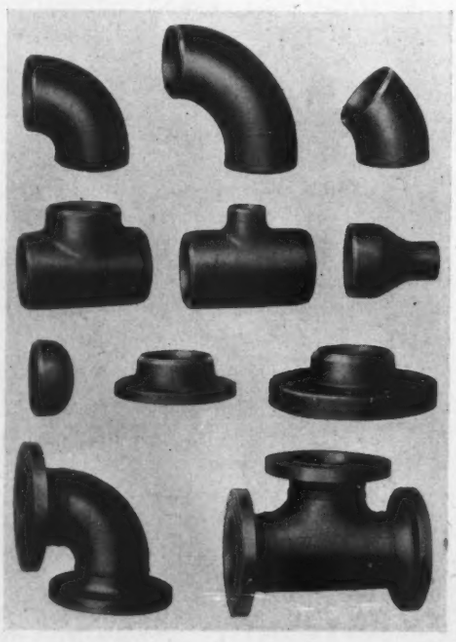
A new catalog describing the L. & N. Micromax Pyrometer in full detail has been issued, and will be sent upon request to Leeds and Northrup Company, 4901 Stanton Avenue, Philadelphia.

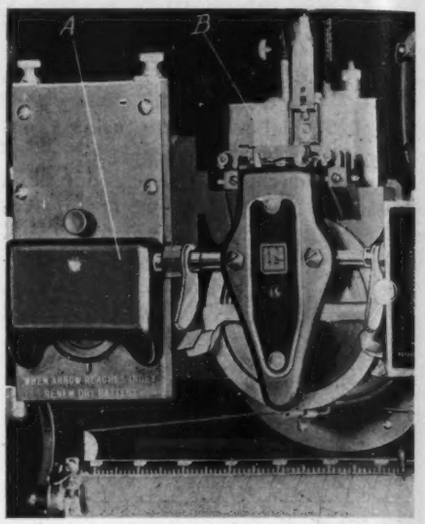
New Pipe Fittings for Welding

TAYLOR FORGE & PIPE WORKS

Taylor Forge & Pipe Works, Chicago, has developed a complete line of seamless steel pipe fittings for welding consisting of elbows, tees, reducing tees, bull plugs, and reducing nipples, as well as Taylor forged steel butt welding flanges which have already been on the market for over three years. All sizes to 24-inch inclusive will be ready for distribution within the near future, but at this writing only sizes 12-inch and smaller are available. The tees are made in sizes two-inches to eight-inches.

This line of "seamless" pipe fittings for welding is unique in many respects. It permits entire pipe systems fabricated by welding to be installed with only the use of true circumferential welds acknowledged to be the easiest to make, resulting in increased efficiency of the welder, and





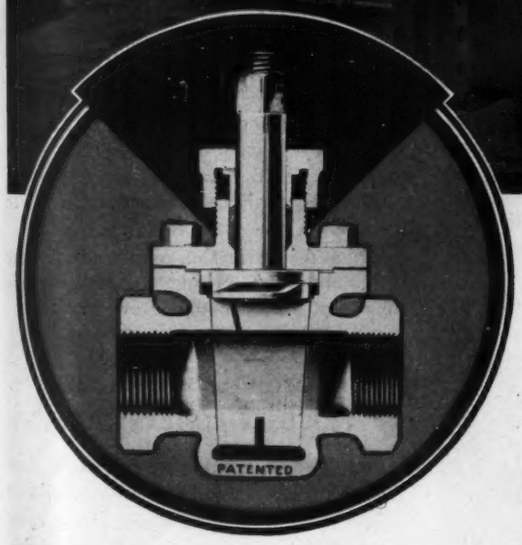
Close-up of the Automatic Standardizer (a) and the more sensitive, quicker-stepping balancer (b) on the L & N Micromax Pyrometer. The self-standardizer operates automatically every 45 minutes or less. It eliminates daily attention, gives closer checks than are obtained by hand, and provides continued Potentiometer accuracy

full strength welds. Erection is considerably simplified. Taylor fittings are lighter in weight than cast steel fittings, and therefore require fewer and lighter supports. They require less space in erection, and in addition, permit easy and economical insulation. The elbows are made without thinning or buckling of the walls, and further have the advantageous feature of short tangents to facilitate welding and accurate lining up. Elbows are made of the standard center to end measurement of American standard extra heavy screwed fittings, and with end to center to end dimension equal to 1½ times the nominal pipe diameter. The ends are machine tool bevelled; this is true of all Taylor forge fittings. Machine tool bevelling provides a smooth, clean surface for welding, and assures maximum accuracy as well as installation ease.

Taylor forge tees are a forged tubular product not to be confused with forged steel tees made solid and drilled out which have been on the market for many years. The tees are made to pipe thickness at the ends, with the body thickened up especially around the outlet to give required reinforcement. The basis of design for the tee, as well as the other welding products, has been to make the fittings of an installation of welded fabricated pipe the strongest parts of the line. Flow or friction has also been carefully considered in design. The tees have sweep outlets, a feature especially important for lines of high velocity.

It is expected that with perfectly designed Taylor forge tees now available, the former practice of welding one pipe into another to form a tee will be elimi-

Where Quick, Positive Valve Action Is Required . . . Use Homestead



These advantages of the Homestead Quarter-Turn Valve mean Longer, Continuous, drop-tight service with lower maintenance costs:

Individually fitted plug
Protected Seating Surfaces
Positive Seating Action
Sealed bottom and bonnet
Stem packed
Instantaneous operation
Rugged Construction

Now, more than ever before, it is important that you keep your operating costs as low as possible by buying valves which save your operators time thru their quick operation, and save costly fluids by means of their positive-acting, metal to metal seat against leakage.

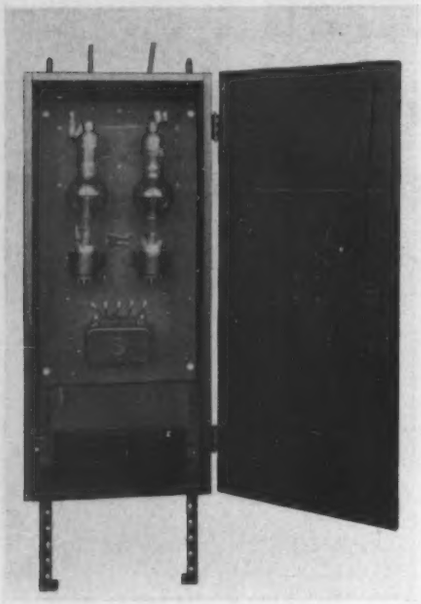
Homestead Valves afford their users these advantages by putting a positive stop to leakage, and giving the same low-cost, instantaneous service day after day, without attention.

Each Homestead Quarter-Turn Valve is cast in metals suitable for the pressure, temperature, and fluid conditions under which they are to be used, so that they give the same low-cost service under each set of working conditions. For instance the user represented by the photograph is profiting from the advantages of thirty, size three inch Homestead Valves on alcohol lines.

Apply the merits of Homestead Quarter-Turn Valves to your refinery for handling hot oil, vapors, tars, air, steam, water, gas, etc. Tell us about your service conditions and we'll gladly recommend the proper valve for your needs.

HOMESTEAD VALVE MFG. CO.

BOX 370 CORAOPOLIS, PENNSYLVANIA



General Electric Thyratron Control for Spot Welding Machine

nated; this practice has always been objectionable to engineers and architects because no one except the welder himself knew how far the branch pipe extended into the run, and consequently serious impaired flow conditions were the inevitable result. From the standpoint of strength, it can be said that the tee weld made by welding pipe together at right angles, receives the greatest stress in a line, yet it is the most difficult weld to make, and being difficult the weld is often very poor and porous.

Favorable features descriptive of other Taylor forge fittings may be briefly stated as follows: The "Reducing Nipples" are designed especially for welding, with the length sufficiently long to aid installation, yet shorter in dimension than that of the screwed reducing nipple. The smooth, well balanced shape of the reducing section assists materially in fostering easy and unimpaired flow. The "Bull Plugs" are forged under the most approved forging conditions; formed to an ellipsoidal shape to withstand end pressure; and made with a surplus of straight section to enable easy and simple attachment to pipe. The "Taylor Butt Welding Flanges," providing for the insertion of valves in welded pipe installations, have a long fillet at the hub to prevent distortion, and are made to satisfy full American standard strength requirements.

By employing Taylor Forge Fittings, three major results are claimed:—uniform strength; unimpaired flow; and, lower installation cost.

Welding Control

GENERAL ELECTRIC COMPANY

General Electric Company, Schenectady, announces a new type of control equipment which makes possible intermittent line and spot welding with interruptions as high as 1000 per minute. This new control uses "thyratron" tubes instead of contractors for interrupting the flow of current.

In addition to the advantage of the high speeds which can be obtained — speeds hitherto impossible with mechanical interruptors or magnetic contactors—contactor wear is eliminated, both on the contactor tips and the entire mechanical assembly.

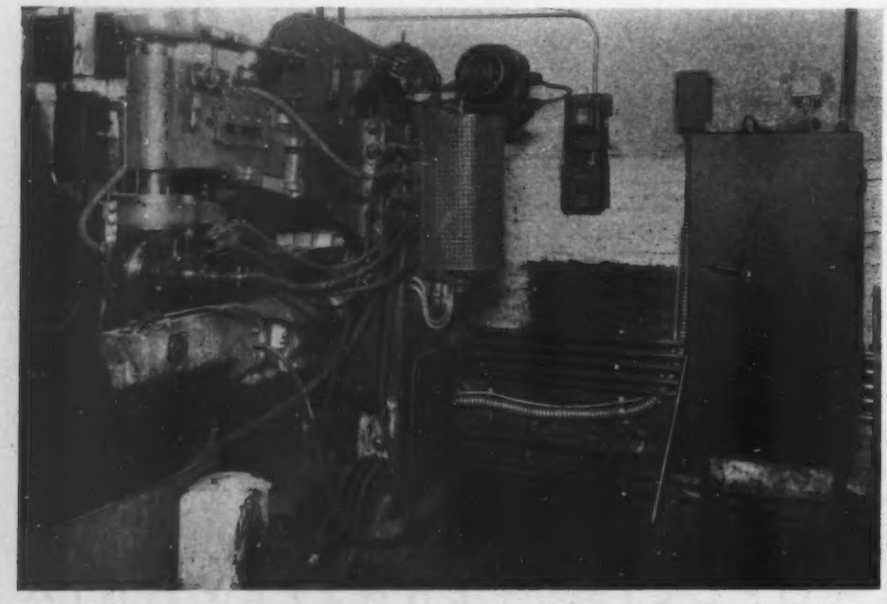
The theory of the new control is as follows: In series with the primary of the welding transformer proper is placed the primary of a series transformer whose secondary is wound for a high voltage. Connected to the high-voltage winding are a pair of thyratrons which, when conducting, virtually short circuit the high-voltage winding. When the high-voltage winding is short circuited, the impedance of the primary or low-voltage winding of the series transformer is very low, thus permitting approximately full load current to pass to the primary of the welding transformer proper. Conversely, when the thyratrons are not conducting the high-voltage winding of the series transformer is open circuited and the impedance of the low-voltage winding is at a maximum, thus permitting practically no current to flow in the welding transformer primary circuit.

Conduction or non-conduction of the thyratrons is controlled by imposing an "in-phase" or "out-of-phase" voltage on their grids; this is accomplished mechanically by the closing or opening of a small single-pole switch.

The new control consists of two essential parts: the series transformer and a control panel. On the control panel are mounted two hot-cathode thyratrons, the filament transformers, grid transformer, a time-delay relay, and the necessary resistors, capacitors, etc.

The new control is expected to find its greatest value on intermittent line or spot welding operations which are a part of continuous, straight-line production where speed is an important factor.

Detailed information on the above may be obtained by writing General Electric Company, Schenectady, New York.



General Electric Thyratron Control on Line Welding Machine

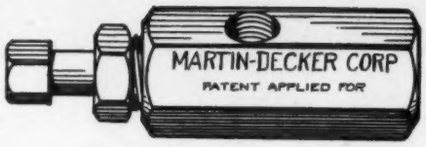
Protective Coating

LIQUILOX COMPANY, LTD.

Liquilox Company, Limited, Los Angeles, has introduced a new liquid protective coating containing no dyes, lamp black, rosin, asphalt, gilsonite, vegetable or animal oils, and offering protection against all acids, alkalies, salts, indirect heats (from 1400 to 1500° F.), waters, barnacles, termites, and miscellaneous destructive forces that deteriorate woods, fabrics, metals, stuccos and cements.

An example of its resistance to alkali follows: Seven plating tanks (of a major plating company), one containing 18 pounds of potassium cyanide per gallon, were coated with one coat of "Liquilox." After 18 months of service the tanks were examined and found to

Designed for "STRAIGHT LINE" CHARTS



The Martin-Decker Pulsation Dampener

Ideal charts from recording gauges for compressors, pumps, pressure controllers, orifice meters, U tubes, draft gauges, or any type of pressure operated devices, are possible with the Martin-Decker Pulsation Dampener. Vibration of indicating gauge pointer is eliminated.

Standard Gauge Connections. Stainless Steel Stem with brass body, or all stainless steel. Reasonably priced. Immediate Delivery.

Unconditionally Guaranteed by the Manufacturer.

MARTIN-DECKER CORPORATION
3431 Cherry Avenue, Long Beach, California

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YOU HAVE WORK TO BE DONE BY COPPUS HEAT KILLERS

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2. Is it building ventilation?
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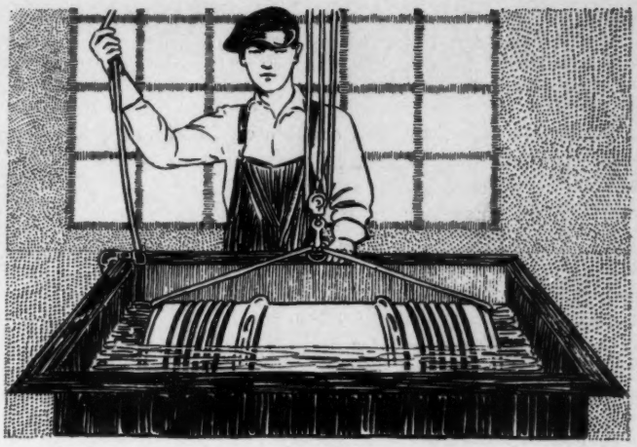


Cuts drum cleaning costs

WITH the method formerly used for stripping old oil drums at a certain Oklahoma refinery, the stripping tank needed recharging every two days. At least eight minutes hand scrubbing was required on each drum.

But, since Oakite materials have been put on the job, this firm is getting amazing results. The Oakite solution lasts a full week. No scrubbing is necessary.

A drum a minute comes from the tank clean to the metal! Stripping costs amount to only a few cents per drum.

Ask our nearest Service Man to call and tell you about Oakite methods for doing this and other cleaning jobs. No obligation.

References:
Report on: Continental Oil Co., Ponca City, Okla.
By: B. C. Browning, 10/10/30.

Oakite Service Men, cleaning specialists, are located in the principal industrial centers of the U. S. and Canada

Manufactured only by
OAKITE PRODUCTS, INC., 50B Thames St., NEW YORK, N. Y.

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods

be in splendid condition and capable of many more months of service without reconstructing or reconditioning.

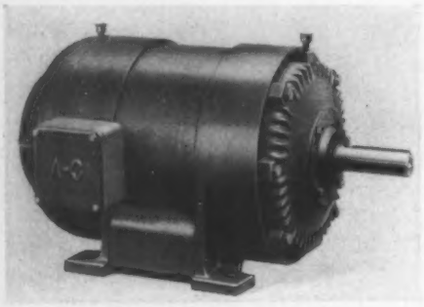
"Liquilox" may be applied with either gun or brush; to hot or cold surfaces; and does not require the use of technical experience for application.

Complete details on this product may be secured by writing Liquilox Company, Ltd., 576 Subway Terminal building, Los Angeles, California.

Explosion Proof Motor

ALLIS-CHALMERS MANUFACTURING COMPANY

Allis-Chalmers Manufacturing Company, Milwaukee, has developed a new line of explosion-proof motors for use in hazardous atmospheres such as are encountered in oil refineries and gasoline plants. These motors have been tested and approved by the Underwriters' Laboratories, and carry the Laboratory's label for use in Class 1 Group D locations, gasoline, (pyroxoline, lacquer vapor).



Allis-Chalmers Motor

The construction of this explosion proof motor is along the same general lines of the Allis-Chalmers totally enclosed, fan-cooled motor, having the same simple design, with all parts readily accessible. Its special features include extra long bearing seals to prevent the escapement of flame and to cool the gases below the point of ignition, special alloy steel cap screws that fit into tapped pockets, and unusual sturdiness to safely resist stresses due to possible internal explosions or flashes.

Details on the new motors may be obtained by writing Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

Gas Leak Detector

REFINERY SUPPLY COMPANY

Refinery Supply Company, Tulsa, recently put on the market a new gas leak detector which the manufacturers claim to be simple, easy to use, accurate, and requiring no calculations in its use.

The R. S. detector consists of a gas burning chamber in the front of which is a window graduated in inches, from 0 to 12. This window is covered with miner's safety lamp screen, so that the flame within the window is visible, yet can not endanger the operator. Gas in the chamber is ignited by means of the lighter, which is operated by turning an ignition knob on the outside of the burning chamber. The orifice through which gas enters the chamber is protected by a screen fire check, tending to abolish any hazard of fire or explosion.

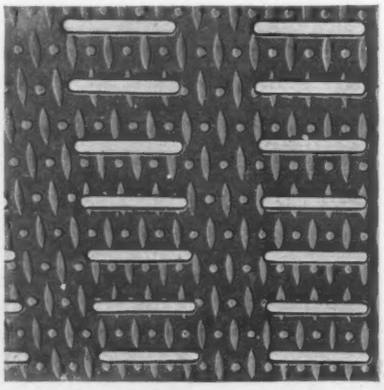
Floor Grating

CENTRAL IRON & STEEL COMPANY

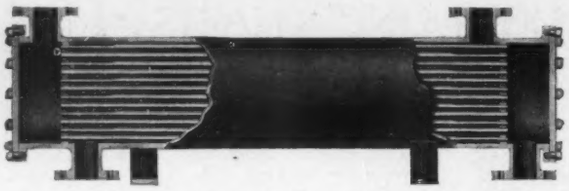
Central Iron and Steel Company, Harrisburg, has placed on the market an improvement over the ordinary fabricated floor grating, the "Slotted Floor Plate." The new slotted floor plate is non-skid and proof against slipping in any direction. Because of its basic design, it requires no deep recess or rabbit in which to set.

These slotted floor plates can be furnished in almost any gauge and size up to 72 inches by 240 inches. A complicated and expensive supporting structure is not required with the slotted floor plate.

Further details concerning the new grating may be obtained by writing Central Iron and Steel Company, Harrisburg, Pennsylvania.



Slotted Floor Plate



Griscom-Russell Heat Exchanger

Heat Exchanger

THE GRISCOM-RUSSELL COMPANY

A novel design of shell-and-tube heat exchanger which has been developed by The Griscom-Russell Company, is of particular interest because of the absence of cross baffles in the shell. Such baffles have heretofore been necessary in order to secure the velocity and turbulence through the shell required for high heat transfer rates. In the G-R Equaflo Exchanger a special form and spacing of the tubes equalizes the total tube and shell cross-sectional areas so that the same velocities of hot and cold fluids are obtained without cross baffles in the shell. These exchangers are applicable to heat transfer services in petroleum refineries, chemical plants, and special process work where the hot and cold liquids or gases are of approximately the same quantities. The special features of this apparatus are outlined in a bulletin which has just been published by The Griscom-Russell Company, 285 Madison Avenue, New York, to whom requests for copies should be sent.

Steam Trap

C. J. TAGLIABUE MANUFACTURING COMPANY

C. J. Tagliabue Manufacturing Company, Brooklyn, is offering to industrial users a new steam trap.

There are several outstanding features of this new steam trap, the company reports, that emphasize its unusual economy in operation. The differential setting feature makes it possible for the steam trap to discharge condensate at a temperature corresponding to a uniform differential pressure from 0 to 20 pounds below the operating steam pressure. If the trap is set to discharge condensate at a temperature corresponding to as much as 20 pounds less than the operating steam pressure, it will discharge the condensate at this differential regardless of whether the steam pressure is 50, 75 of 125 pounds, and without any further adjustment of the differential setting.

When the differential setting screw is all the way up on the trap, there is no tension on the spring and the trap will discharge condensate from 1 to 2

Seven Principles of Kellogg Service

1. Analyze and know the charging stock.
2. Design for capacity without overloading.
3. Select materials of tested fitness.
4. Fabricate only the best.
5. Erect for steady, unfailing operation.
6. Complete construction as scheduled.
7. Demonstrate plant performance.

A battery of three Kellogg topping stills running a daily total of 30,000 bbls. of Mid-Continent Crude

"Design for capacity without overloading"

. . . . *the second principle of Kellogg Service*

The long, efficient life of Kellogg equipment is due in part to the sound conservatism of Kellogg refinery design. Kellogg stills are designed for a specified capacity, and they operate at that capacity without overloading.

The M. W. KELLOGG CO., *225 Broadway, New York*

LOS ANGELES, CAL., 1031 SOUTH BROADWAY TULSA, OKLA., PHILTOWER BUILDING

Kellogg products include Cross, Holmes-Manley, and de Florez cracking units; de Florez furnaces and temperature control apparatus; pipe stills; Pacific Centrifugal Pumps; absorption, stabilization, and treating plants; Masterweld pressure vessels; complete refinery and power plant piping

TO CARRY
STEAM-OIL
or CHEMICALS
Over 83 carloads of piping in a recent refinery installation by this company (of which the illustration shows a part) completed with exacting accuracy . . . the result of specialized ability and experience. Design, fabrication, installation—
put it up to Power Piping
POWER PIPING CO. • PITTSBURGH

degrees below the temperature of the operating steam. When tension on the spring is applied, by simply turning down the setting screw, a mechanical pressure is created on the inside of the skillfully designed bronze bellows which aids the vapor pressure developed in the bellows to close the valve. Thus the amount of mechanical pressure exerted by the spring determines whether the trap will close at the temperature of the operating steam or 5, 15, or 25 degrees below this temperature. And, in reverse effect, whether it will open to discharge condensate at 1 to 2 degrees below the operating temperature of the steam or at 7, 17, or 27 degrees below that temperature.

There are reversible as well as renewable Monel seats and discs. Simply by unscrewing and reversing the seat the outlet end becomes a new seat. Merely by inverting the disc, the reverse, extra disc is brought into play.

Additionally, a sturdy and compact hand sized bronze body and guaranteed bronze bellows round out a sincerely fine product.

Further details on the steam trap may be obtained by writing C. J. Tagliabue Manufacturing Company, Park and Nostrand Avenues, Brooklyn, New York.

New Gasket

FLEXITALIC GASKET COMPANY

Flexitallic Gasket Company, Camden, New Jersey, has placed on the market a new gasket for re-use and made of asbestos and metal, the metal used being determined by the use to which the gasket is to be put.

When it becomes necessary to remove the gasket for some reason after it has been in service for a while, release of pressure allows them to have a comeback from 30 to 40 per cent, according to the manufacturers. There is a double thickness metal reinforcement at the center of the gasket which is clinched, preventing the gasket from spreading under pressure.

Complete details concerning the new type of gasket may be obtained from Flexitallic Gasket Company, Eight and Bailey Streets, Camden.

Manometer

THE MERIAM COMPANY

The Meriam Company, Cleveland, has recently put on the market a new type of manometer, called the "Clean-Out" manometer because it permits cleaning out the glass tube easily without disconnecting the piping. To accomplish this, a special type brush is supplied with the manometer.

Other features of the manometer are that it allows liquid therein to come to zero when shut off; the wing nut and bolt are made of forged steel and can be tightened with a screw driver;

Carbondale Refrigeration for Refiners

CARMACO

Send for a Copy of our Wax Plant Bulletin

Design of Complete Wax Plants—Absorption and Compression Refrigerating Machines—Wax Distillate Chilling Machines—High Pressure Filter Presses—Paraffine Wax Sweaters—Heat Exchangers and other Refinery Equipment.

CARBONDALE MACHINE COMPANY, CARBONDALE, PA.
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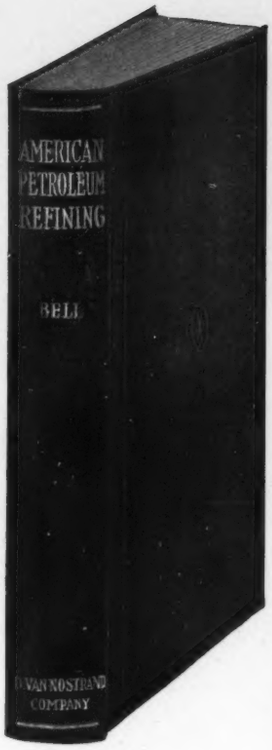


American Petroleum Refining

By H. S. BELL, C. E.

Second Revised Edition Completely Revised and Brought Down to Date.

Every detail of American refinery practice—the most up-to-date developments as well as the standard methods—are fully covered in this book. Vapor phase cracking, the production of high compression gasoline, the development of modern pipe stills, the use of Diesel engines in oil pumping, and hundreds of other subjects of equal interest and importance, are discussed, covering in full every detail of oil refinery operation, engineering, and design.

630 pages, Buckram, 6x9, illustrated, Postpaid $6.00

Send Order to

THE GULF PUBLISHING CO.,
P. O. Box 1307, Houston, Texas

the frame is made of cast aluminum; the pyrex or boro silicate glass tubing has a large hole and is easily filled; it will stand a pressure up to 500 pounds per square inch.

Further details concerning the "Clean-Out" manometer may be obtained by writing the Meriam Company, 1955 West 112 Street, Cleveland.

Time Cycle Contactors

AUTOMATIC TEMPERATURE CONTROL COMPANY, INC.

Automatic Temperature Control Company, Incorporated, Philadelphia, recently issued bulletin 1212 describing that organization's line of time cycle contactors.

Contactors described and illustrated in the bulletin are manually operated cycle stop types, semi-automatic cycle stop types; automatic cycle repeating types, and cycle program types.

Features that make the contactors of this company distinctive are the means for making accurate time cycle adjustment—as close as one-fifth second is possible with the minute dial range—and the lattitude of time contact held adjustment.

Complete details on the contactors may be obtained by writing Automatic Temperature Control Company, Incorporated, 34 East Logan Street, Philadelphia.

Prest-O-Weld Cutting Apparatus

LINDE AIR PRODUCTS COMPANY

Linde Air Products Company, 30 East 42nd Street, New York, has recently added a cutting blowpipe and cutting attachment to its new line of "Prest-O-Weld" medium-pressure apparatus of the detachable valve body design. The new cutting apparatus includes the "Prest-O-Weld Type C-105 cutting blowpipe and the Prest-O-Weld Type CW-105 cutting attachment.

These two types of cutting apparatus, together with the Types W-105 and W-106 welding blowpipes previously announced, can all be used interchangeably with the same detachable valve body. By means of the detachable valve body, the operator can change easily and quickly from a full size welding blowpipe to a smaller welding blowpipe, to a full size cutting blowpipe, or to a cutting attachment without detaching the hose or hose connections and without the use of a wrench.

The locking device for connecting the detachable valve body to any one of these blowpipe handles consists of a locking bolt and wedge-shaped locking screw. The locking screw is operated by turning a ring and draws the detachable valve body and blowpipe handle together making a gas-tight joint. The ring can also be used for hanging up the blowpipe when not in use.

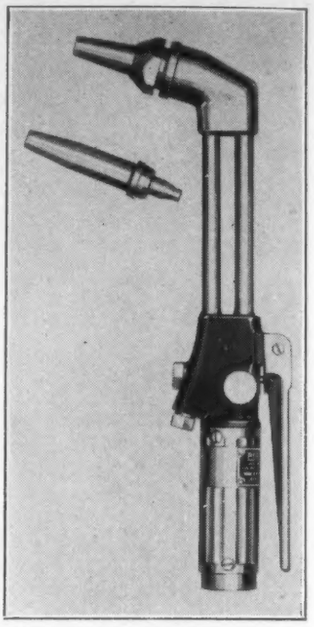


FIGURE 1

Prest-O-Weld Type C-105 *Cutting Blowpipe*

Pressure forgings are used in the construction of the blowpipe head, cutting valve body and lever. The cutting oxygen tube is made of Ambrac, a special hard brass, to afford the necessary stiffness. The cutting nozzles have conical seats so designed that they will not become nicked or damaged if the nozzles should be accidentally dropped.

The blowpipe is light and well-balanced, but at the same time it is of sturdy construction to withstand the hard usage to which cutting blowpipes may be subjected. It is furnished as standard with four cut-

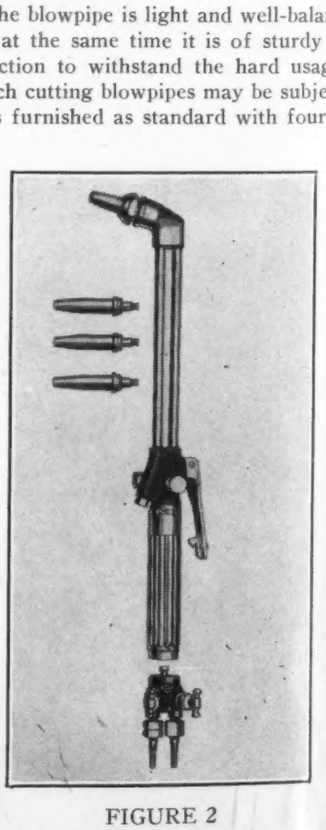


FIGURE 2

Prest-O-Weld Type CW-105 *Cutting Attachment*

Designed for Oil, Gas and Pulverized Fuel Firing

BURNERS PEABODY

Peabody Engineering Corporation

46 EAST 41ST STREET, NEW YORK

The Spiral Motion Is the Trick

That's why Hood's Chemico Spiral Packing Rings have been selected by so many engineers. The center hole prevents choking and clogging.

Made of acid-resisting shale—practically indestructible.

Used by all big producers because of the intensive movements.

Samples on request

B. MIFFLIN HOOD CO., DAISY, TENN.

ting nozzles and a 75° angle head. If required, a 90° angle head can be furnished. Steel and wrought iron up to 12 inches in thickness may be easily cut with this blowpipe and metal of greater thickness can be cut by experienced operators.

The Prest-O-Weld Type CW-105 cutting attachment is of the single joint design and attaches directly to the valve body. It will readily cut metal up to two inches in thickness. Because of its small size, only 11 inches overall, it can be conveniently carried in the pocket of the operator when not in use. All the advantages of design and construction embodied in the full size Type C-105 cutting blowpipe are incorporated in this cutting attachment. It is furnished with nozzles Numbers 1 and 2 of the same type as used on the Type C-105.

G-Fin Gas Cooler

THE GRISCOM-RUSSELL COMPANY

The Griscom-Russell Company, New York, is introducing the new G-Fin gas cooler.

This new gas cooler overcomes the usual difficulty of bulk in order to provide sufficient heat transfer surface for the desired cooling effect, by increasing the effective area on the side of the heat transfer surface which is presented to the hot gas or vapor. This is accomplished by means of radial fins securely fastened to the outside of the tubes through which the cooling medium flows. The hot fluid passes along the channels formed by these fins and the large total fin surface provides many times the heat absorbing area of the same number and length of bare tubes. As a result the G-Fin gas cooler is compact for a given duty.

This new unit is described in a booklet just printed and which explains its construction and special features. Copies of this leaflet may be obtained by writing Griscom-Russell Company, 285 Madison Avenue, New York, New York.

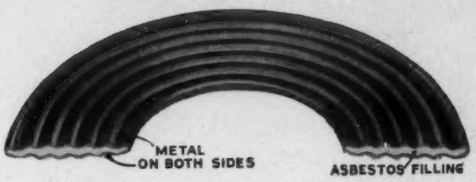
Wright Electric Trolley Hoists

WRIGHT MANUFACTURING COMPANY

Wright Manufacturing Company, Bridgeport, Connecticut, is introducing a new line of Wright electric trolley hoists complete in every respect, consisting of the plane, geared, and motor driven trolley types. The bearings of the trolley wheels are designed to absorb both radial and thrust loads, thus reducing the effort to move the trolley along the I-beam to a minimum.

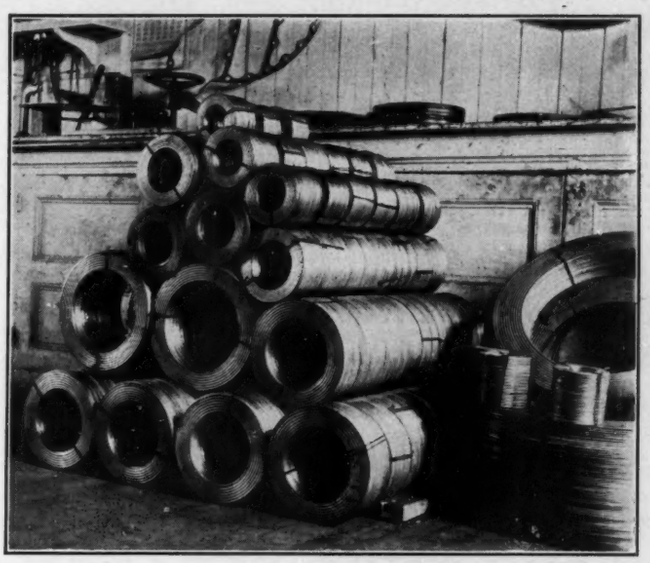
The trolleys come in plain, geared, and motor driven patterns. In the motor driven trolleys, the wheels are driven on each side of the I-beam insuring smooth operation, and are equipped with a safety stop. Controllers for single speed, two speed, or variable speed can be furnished.

The hoists can be mounted either parallel or at right angles to the runway



METALLO
STYLE 1000 » »

REFINERY TYPE
METAL-ASBESTOS
GASKETS



Recent shipment of 3,180 Metallo Style 1000 Refinery Type Gaskets for Series 30 flanges

Whether you use Dubbs, Cross, Tube and Tank, Jenkins or Lewis Cracking Process, you can rely implicity on Metallo Refinery Style 1000 Gaskets for all tongue and groove, male and female joints, and extra heavy flanges. Constructed with double jacket of corrugated Armco Iron, Steel, Monel Metal, Aluminum, Copper or Chromium Alloys, with filling of Asbestos, it is particularly adapted for any joints on cracking stills where pressures are up to 2,000 pounds, and temperatures up to 2,000 degrees Fahrenheit.

Write for Prices.

METALLO GASKET CO.
NEW BRUNSWICK — NEW JERSEY

W. N. BEST High Pressure Oil Burner

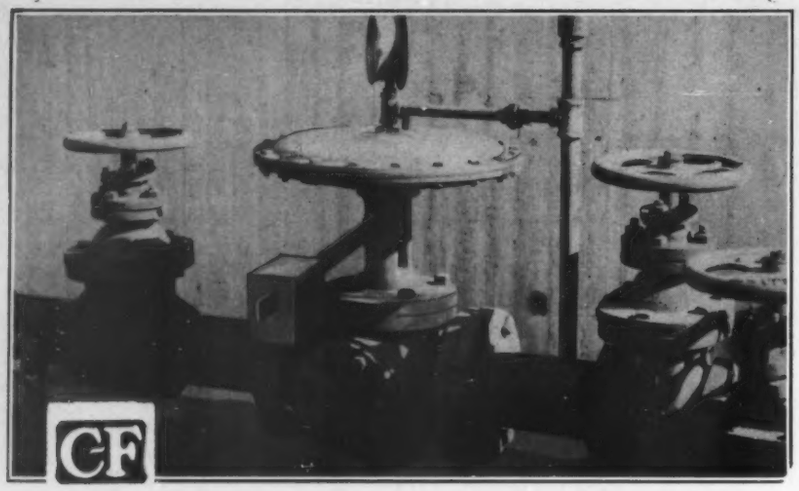
W. N. BEST Oil Burners

are

dependable, efficient, economical, non-clogging atomizers of fuel oils, tars, acid sludges and still bottoms.

Write for catalogs.

W. N. BEST CORPORATION
Engineers and Manufacturers Since 1890
295 Fifth Avenue, New York City



Low Pressure Regulation

Pressure regulation at the Sinclair Plant, Garber, Okla., is effected with this duplicate set of Fulton Low Pressure Regulators, with automatic cut-off. Our improved style of valve makes a perfectly tight joint, thus preventing any increase of pressure on the low side when the consumption is light or entirely shut-off; and being perfectly balanced, it is not affected by the variations of pressure that may occur on the inlet side. Made in all sizes up to 24 inch.

Write for catalogue giving full information on this and other types of gas pressure regulation equipment

THE CHAPLIN-FULTON MFG. CO.

28-40 Penn Avenue Pittsburgh, Pa.

Organized 1884—Oldest Builders of Gas Regulators in the Country. Built in all Sizes, from 1 inch to 24 inches; for all Service. 1 oz. up to 2,000 lbs. Pressure to Square Inch.

Representatives:

Westcott & Greis, Inc. Jno. W. Crawford

Sales Service: Dallas—Los Angeles—Tulsa *Sales Engineers:* 1855 Industrial St., Los Angeles Or Any Jobber

ROTO TUBE CLEANERS

built for Oil Still Tubes, 3″ I. D. *and up*

Roto Special 6-way Drill Head and Universal Joint.

Roto Air Driven Cleaner with Swing Frame Head attached.

Roto Combination Head and Universal Joint.

THE ROTO COMPANY

Sussex Avenue and Newark St., Newark, N. J.

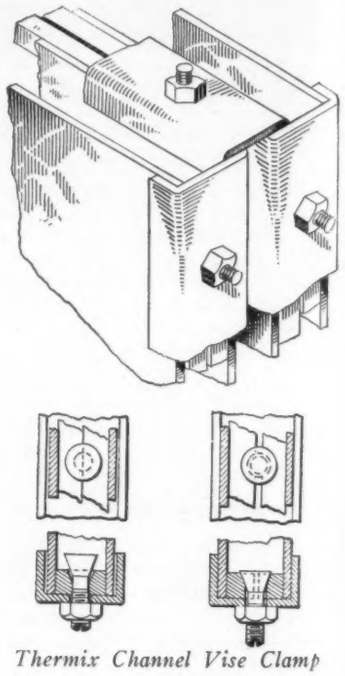
beam. While the standard lift is 18 feet, lifts of nine and 36 feet can be furnished.

Features of the hoist include full size drums for long cable life, push button or pendant rope control, "Tru-Lay Preformed Cable," safety type limit switch, positive braking, and weather proof motors.

Air Heater

PRAT-DANIEL CORPORATION

Prat-Daniel Corporation, New York, have placed on the market a "Thermix" air heater designed to cut down fuel loss in boilers, oil stills and metallurgical furnaces.



Thermix Channel Vise Clamp

The heater is of the plate type, consisting of a series of rectangular plates, arranged in parallel planes, and spaced about one inch apart, thus dividing the air and gas into thin sections passing in counter-current flow through alternate passages between the plates.

Edges of the plates are held by means of a vise which is composed of a channel, against the inside flanges of which rest the edges of the heater plates.

Detailed information on the new heater may be obtained by writing Prat-Daniel Corporation, 183 Madison Avenue, New York, City, New York.

Electric Motor Starter

ELECTRIC CONTROLLER & MANUFACTURING COMPANY

Electric Controller and Manufacturing Company, Cleveland, recently put on the market a new type of motor starter known as the "No. 2 Type ZO Across-the-line Motor Starter."

The starter is a self-contained unit enclosed in 16-gauge steel with oil immersed main and control circuit contacts and vapor proof overload relays. These features render the starter safe for operation under any adverse atmos-

pheric condition, according to the manufacturers.

Two thermal type overload relays are used on the starter to protect the motor against single phase and overload conditions. These relays have high heat inertia to withstand heavy overloads.

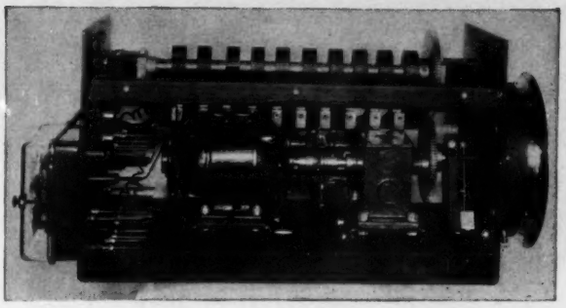
Complete information on the "No. 2 Type ZO Across-the-line Motor Starter" may be obtained by writing Electric Controller and Manufacturing Company, 2700 East 79 Street, Cleveland.

Multi-Contact Making Pressure Gauges

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

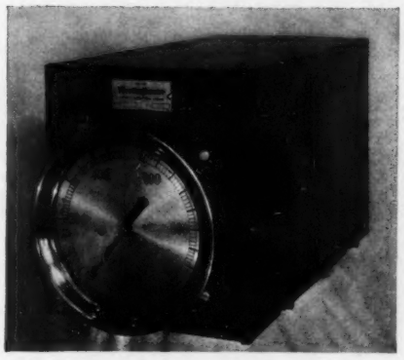
Westinghouse Electric & Manufacturing Company, Pittsburgh, has developed a multi-contact making pressure gauge for use with supervisory control systems to indicate certain pressure readings at a remote point. It was developed for use with a pipe line pumping station to give remote indications of intake and discharge pressures.

Ten adjustable contacts are placed at predetermined intervals over the scale of the pressure gauge. When the pressure changes sufficiently to make a new contact, a code of impulses is sent over the supervisory control wires to indicate the change to the dispatcher. Thus all changes are automatically sent through without the use of extra live wires.



Inside of Westinghouse Pressure Gauge

In general, the device consists of



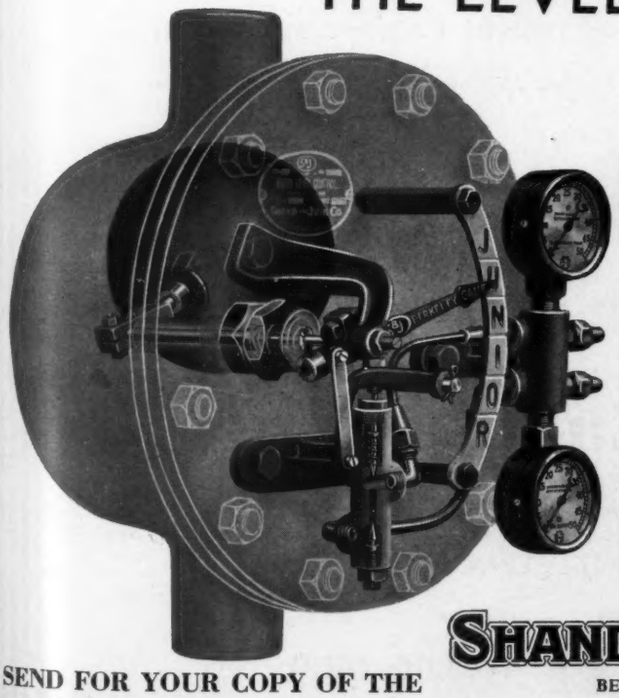
motor driven contacts are made to follow the pressure gauge. To accomplish this, the shaft of the pressure gauge is extended through to the rear and a contact mounted on it which will follow the change in pressure. As the pressure tends to change up or down, it strikes another contact, is connected directly to a motor-driven shaft which rotates in a direction to cause the contact to again open. Thus the motor-driven contacts will move or rotate in response to variations in pressure as indicated by the pressure gauge. The contact carried along with the pointer has no mechanical connection to the rest of the device.

The indicating contacts have a capacity of five amperes at 125 volts. The case is made practically dust-proof and made for table or similar mounting.

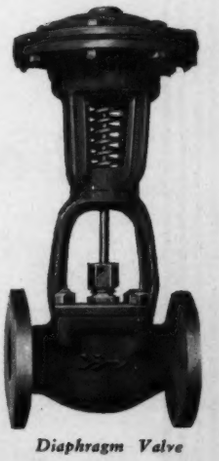
The device is usually made for storage battery operation so that readings of pressure will be accurate even though the a-c. supply to the pumps is interrupted.

WHEN YOUR PROBLEM IS TO CONTROL THE LEVELS OF HIGH GRAVITY LIQUIDS

DO IT WITH S. & J. IMPROVED EQUIPMENT



YEARS OF SATISFACTORY SERVICE controlling levels of Butane the Edeleanu Process, and liquids at pressures over 500 pounds and temperatures up to 1000 degrees, prove without a doubt that the Supersensitive Differential Type Air Valve, the use of Nirosta KA2 stainless steel float and trim, and the simplicity of the equipment are ALL SOUND PRINCIPLES NOT TO BE OVERLOOKED.



Diaphragm Valve

SHAND AND JURS CO.

BERKELEY, CALIFORNIA

New York Denver Tulsa Los Angeles Seattle Houston

SEND FOR YOUR COPY OF THE NEW BULLETIN NO. 50-A

To The Oil Refining Industry...

We are pleased to announce that after several years of both field and laboratory work and the securing of certain patents, among them Gibson numbers 1,712,881 and 1,782,-683, we are now in a position to furnish gas burning systems for all types of stills and refining processes, including the vertical stills, either top or bottom firing. The equipment furnished is built to fit each condition and is not a standard design but the principle is the same in all cases. We are in a position to make guarantees for increasing the present furnace capacity of your equipment as well as decreasing furnace maintenance. We have competent Engineers who are now available to make the necessary surveys and recommendations without charge to you.

The Webster Engineering Co.

Subsidiary of

THE SURFACE COMBUSTION CORP.

TULSA, OKLA. TOLEDO, OHIO

CATALOGS - BULLETIN - BOOKS

American Cast Iron Pipe Company's Doublex Simplex pipe catalog is ready for distribution to users of pipe and fittings. It contains 48 pages of useful information and is profusely illustrated.

The catalog describes in detail Mono-Cast Doublex Simplex cast iron pipe. It is recommended for both high and low pressures.

American Rolling Mill Company, Middletown, recently issued a 32-page book titled, "How Armco Ingot Iron Saves in the Oil Industry". Things discussed include fighting corrosion, rust resistance, uniformity, eliminating welding variables, transmission of heat by ingot iron, physical and tensile properties, iron rivets and the economy of pure iron pipe in producing and refining service.

A copy of the book may be obtained by writing American Rolling Mill Company, Middletown, Ohio.

American Lava Corporation, Chattanooga, recently published catalog No. 32, describing the quality and picturing the multitudinous applications of lava and magnesia insulation specialties.

As a dielectric, lava will withstand high potentials for an indefinite period with remarkable uniformity, will withstand higher temperatures than 2000° F., is free from variations in structure and composition, is unaffected by moisture, has a compressive strength of 20,000 pounds per square inch, and is non-corrosive and non-carbonizing, according to the manufacturers.

A copy of catalog No. 32 may be obtained by writing American Lava Corporation, Chattanooga, Tennessee.

The Carrick Engineering Company, 431 South Dearborn Street, Chicago, announces a new four-page bulletin "Carrick Stiff-Arm Fittings." Of entirely new and improved design these fittings offer further evidence of the important changes recently made in the "Carrick System of Automatic Combustion Control."

Diamond Alkali Company, Pittsburgh, announces a new edition of the 72-page **Diamond** Alkali Handbook. This publication gives the specific and Baume gravity, temperature, solubility, carries tables for crystalizing temperature of caustic soda and instructions for unloading tank cars.

Bicarbonate of soda, liquid chlorine and soda ash are covered in the hand book as to manufacture and uses.

A copy of this handbook may be obtained by writing Diamond Alkali Company, Koppers building, Pittsburgh, or by writing Fred W. Fraley, 1006 Main Street, Houston, Texas.

Gardner-Denver Company, Quincy, Illinois, has issued a new 32-page bulletin, PC4, illustrating and describing the various sizes and mountings of its portable compressor line. Engineering features include force feed lubrication with filtered oil, generous bearing areas, and the simplicity of the automatic control system. Bulletins may be secured direct from the company's offices.

General Electric Company, Schenectady, recently published catalog GEA-77D, superseding GEA-77C, and devoted to capacitators for power factor correction.

The illustrated catalog explains the application of capacitators, how they improve power factors, capacitator calculations. Then follows descriptions of various types of capacitators made by the company.

A copy of the catalog GEA-77D may be obtained by writing General Electric Company, Schenectady, New York.

General Electric Company, Schenectady, recently issued catalog GEA-1441 entitled "Electric Equipment for Oil Refineries." It is a 48-page illustrated book carrying an additional 13 pages of inserts describing equipment not listed in the book proper.

This bulletin is prepared in order to familiarize the oil refinery operator with some features of General Electric products and their manner of application in a few specific instances. Frequent reference is made to other publications containing more detailed information regarding individual units.

A copy of the book GEA-1441 "Electric Equipment for Oil Refineries" may be obtained by writing General Electric Company, Schenectady, New York.

General Refractories Company, Philadelphia, has issued a 16-page illustrated booklet entitled "High Temperature Mortars and Plastic Chrome Ore." The booklet gives complete descriptions of the applications and advantages of these products. A copy of it may be obtained by writing General Refractories Company, 106 South 16 Street, Philadelphia.

Glyco Products Company, Inc., Brooklyn, has issued a handy leaflet which contains many formulae which describe the preparation of emulsions of gasoline, naphtha, turpentine, linseed and other oils as well as waxes. The leaflet also describes ammonium linoleate, a soap whose most interesting characteristic is that the ammonia splits off, when exposed to air, leaving a film of linoleic acid. The latter oxidizes and forms a water insoluble film. Further information will be furnished on request to the company, Bush Terminal building, Brooklyn, New York.

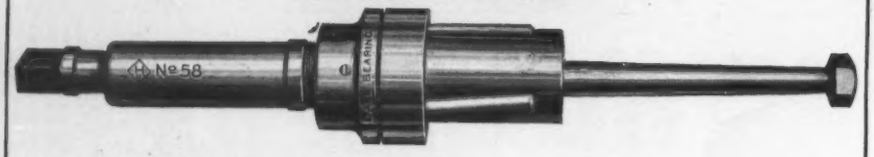
J. E. Lonergan Company, Philadelphia, has issued a 92-page illustrated catalog showing the company's line of pop safety valves, relief valves, pressure and vacuum gauges for steam, air, water, amonia and the like, test gauges, water level gauges, gauge cocks and syphons, oil cups, grease cups, multiple oilers and other lubricating specialties.

A copy of the catalog may be obtained by writing J. E. Lonergan Company, Philadelphia, Pennsylvania.

Mercoid Corporation, Chicago, published recently catalog No. H-7, a 112-page, fabricoid bound book describing Mercoid Controls, panel

Hy-Speed
EXPLOSION-PROOF
MIXERS
Hy-Speed Portable Electric Mixers are the most efficient machines manufactured for blending, compounding, mixing or agitating all oils and liquid chemicals.
They clamp to any tank or vat in one minute and produce a more thorough, rapid mix . . . . more economically than by any other process. Capacities from five to 50,000 gallons.
Write for your copy of «The Hy-Speed Age» ..... the Solution of your Mixing Problems.
ALSOP
ENGINEERING
COMPANY
47 West 63rd St.
New York City
For mixing
LUBRICATING OILS
LIME AND OIL
FULLER'S EARTH & OIL
ALL LIQUID CHEMICALS

Heavy Duty Expanders for Still Tubes



Tools for the Oil Industries

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches

A. L. HENDERER'S SONS
Wilmington, Del.
Established 1870
Expanders since 1884

GAS BURNERS

Heat Without Flame

Burn Rectifying Column Vapors and Still Gases

WITH A SHORT FLAME

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Over Six Thousand John Zink Burners in Use

JOHN ZINK COMPANY

Oklahoma Natural Gas Building — Phone 4-9838
TULSA, OKLAHOMA

Catalogs—Bulletins—Books

units, valves, switches and other related instruments of control. In the back of the book are several pages of wiring diagrams.

Mercoid controls are made for automatic or semi-automatic direct control of motors where the working load does not exceed 10 amperes at 110 volts or five amperes at 220 volts with alternating or direct current. All types of Mercoid controls employ a sealed glass tube switch containing inert gasses and mercury, thus eliminating exposed conduction surfaces and their resultant open-arcing, oxidation and corrosion.

A copy of catalog No. H-7 may be obtained by writing Mercoid Corporation, 4201 Belmont Avenue, Chicago.

The Moon Manufacturing Company, Chicago, has issued a bulletin describing new Type 8, 5 and 7½ KW Turbo generators. This bulletin details general construction features and gives detailed data on the Type 8 generator with specifications and a lamp table for all models. Uses of Moon generators are pictorially described on the back of the bulletin.

Neilan Company, Limited, Los Angeles, recently published bulletin 2000-B describing a new pressure control instrument which contains a number of distinctive features.

Principal among the advanced features of the pressure control explained in the illustrated catalog are the reducing valve for air or gas operating supply; safety relief valve on operating air or gas reservoir; reservoir drain; gauge for operating air or gas pressure; pressure balanced compound pilot valve; staple for converting from back pressure to reducing service; synchronizer; an helical coil which operates the control mechanism; a gauge indicating pressure on control valve diaphram; helical coil for actuating pen arm; pressure setting indicator; an improved method of pressure setting; and a spring winding clock for turning recording charts.

A copy of bulletin 2000-B may be obtained by writing Neilan Company, Limited, 641 Santa Fe Avenue, Los Angeles.

Page Steel & Wire Company, Bridgeport, Connecticut, announces a new booklet devoted to Page fence, published by Page Fence Association. The booklet contains various style sheets of chain link and wrought iron picket fences, and includes logical reasons why well-fenced property is safe and economical. This booklet is titled "The Border Patrol." Another booklet, "Why Aluminum Fence," has been published by Page Steel & Wire Company, and outlines the development in the fence industry recently of aluminum for the manufacture of woven wire fences. A copy of either or both of these booklets will be mailed interested persons upon request to Page Steel & Wire Company, Bridgeport, Connecticut.

Pomona Pump Company, Pomona, California, has issued a 32-page bulletin on deep well pumps. This bulletin illustrates the complete line of water lubricated turbine pumps manufactured by this company, and includes approximately 100 installation views of the pumps in action in all types of industries. It also includes a number of valuable reference tables which can frequently be used by the operator of deep well pumps. Details of pump construction are given 600 horsepower in application, are described. Requests for a copy of this bulletin should ask for Number 16a.

Catalogs—Bulletins—Books

Republic Steel Corporation, Massillon, Ohio, has issued a booklet called "Enduro FC", describing the FC type of stainless steel, one of the most recent additions to the family of stainless steels.

According to the manufacturers, type FC was developed to meet the demand for an alloy combining the free cutting qualities of Bessemer screw stock with the corrosion and heat resisting qualities of Enduro stainless steel. The bulletin contains quite a bit of interesting and authentic information on free cutting alloy.

Copies of the booklet "Enduro FC" may be obtained by writing Republic Steel Corporation.

The Roots-Connersville-Wilbraham division of International-Stacey Corporation, Connersville, Indiana has just issued four new bulletins covering standard and heavy duty blowers and gas pumps.

These bulletins supersede all former bulletins on these products issued separately in the past by P. H. & F. M. Roots Company, Connersville Blower Company, Inc., both of Connersville, Indiana, and Wilbraham-Green Blower Company, Pottstown, Pennsylvania.

H. O. Swoboda, Incorporated, Pittsburgh, recently issued Bulletin No. 230 describing "Falcon" electrically heated melting and coating tanks suitable for asphalts, tars, compounds, varnishes, oils and similar viscous materials. A copy of the bulletin may be obtained by writing the manufacturer at 3400 Forbes Street, Oakland Station, Pittsburgh.

C. J. Tagliabue Manufacturing Company, Brooklyn, has issued a new general catalog No. 1000 describing instruments for indicating, recording and controlling temperature, pressure, temperature humidity, moisture, time, gas analysis, condensation and liquid level, as well as describing industrial thermometers, laboratory thermometers and hydrometers and oil testing instruments manufactured by that organization.

General catalog No. 1000 contains 102 pages of charts, pictures, diagrams and tables used to illustrate and explain uses of the many instruments listed. In addition, the catalog carries along with the instrument descriptions the story of their manufacture.

A copy of the catalog may be obtained by writing C. J. Tagliabue Manufacturing Company, Park and Nostrand Avenues, Brookyln, New York.

Tube-Turns, Inc., Louisville, has published a bulletin containing a chart to allow fast and accurate calculation of expansion loops made up with tube-turns and straight runs of pipe. The chart offers a rapid and convenient method of designing the loops. With it the engineer can plan dependable loops of the correct size to care for any given amount of expansion. The length of the run of pipe at the top of the loop, or of the side legs, can be limited to any construction requirements.

A copy of the bulletin may be obtained by writing Tube-Turns, Incorporated, Shelby and Goss Avenue, Louisville, Kentucky.

Webster Engineering Company, Tulsa, has just published the Webster Manual and Data Book, after two years of compilation. It is a collection of information on industrial gas-fired burner design and application, and contains 120 pages.

Copies may be obtained by writing the Webster Engineering Company, Tulsa, Oklahoma.

SOLVAY*
TRADE MARK REG. U. S. PAT. OFF.
PRODUCTS

1881
Golden Anniversary
1931

50 Years
of
Solvay Leadership

58% Soda Ash
Caustic Soda

Solid—Flake—Ground—Liquid

Leading refiners depend on these products for the quality and uniformity which industry inevitably associates with the name Solvay. First in pioneering the development of American sources of alkali, The Solvay Process Company is recognized as the outstanding leader of its field—first in size and first in facilities for rendering efficient service. Strategically located distributing points ensure prompt delivery of Solvay products with minimum transportation charges.

Write today for prices and full information.

Solvay Sales Corporation

Alkalies and Chemical Products Manufactured by The Solvay Process Company

61 Broadway New York

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If your problem is one of Vacuum

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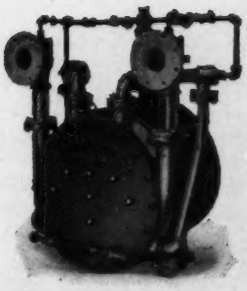
C. H. Wheeler Mfg. Company
19th St. Lehigh & Sedgley Ave.
PHILADELPHIA, PA.



KNOW
your flow conditions
. . . at a glance
with the

MJL Flow Indicator

Refinery conditions today demand accurate knowledge of process flow. You read flow of gases, water, oils, air, steam or chemicals *directly* in the proper units with the M. J. L. Flow Indicator—regardless of flow conditions, constant or variable.

Close Hook up Type mounts directly on the flow line, handy to control valve. Operators appreciate the unique convenience of this type.

Remote Hook up Type permits mounting Indicator at any convenient distance from the pipe line—as in a meter house or operator's quarters.

Bulletin 208 tells *how* . . . MJL **Send for *your* copy**

MOREY & JONES, Ltd.
Manufacturing Engineers
920 Hemlock Street Los Angeles, California

It's Safe and Economical to Use . . .

Pulmosan Hose Mask No. 1

Designed for use in confined quarters, such as tank cars, manholes, etc., where funnel may be extended to a source of fresh air. Outfit consists of face mask with 25-ft. non-collapsible, kink-less, 1-inch hose, with connecting pad, hook and funnel—all contained in neat, sturdy carrying case. The coupon brings detailed information and interesting prices on this, and other types.

Let PULMOSAN solve your safety problems. Write for circulars on Asbestos outfits, non-sparking tools, etc.

PULMOSAN SAFETY EQUIPMENT CORP.,
176 Johnson St., Brooklyn, N. Y.

Gentlemen: Kindly send full information on your (please check)

☐ Pulmosan Hose Masks ☐ Pulmosan Respirators
☐ Non-sparking Tools ☐ Asbestos Outfits

Name .....

Address ..... (R)

Catalogs—Bulletins—Books

York Ice Machinery Corporation is distributing its new bulletin 31153 describing its new York oil chiller which was designed for low temperature chilling of paraffin wax distillate. The bulletin presents a detail drawing of the chiller showing construction and design features.

Byron Jackson Company, Berkeley, recently issued bulletin No. 314, a 40-page illustrated catalog titled "Oil Refinery Pumps." In the catalog are shown hot oil charging pumps of various types, cold oil charging pumps, various types of distillate pumps, reflux pumps, still circulating pumps, and foam smothering pumps. The bulletin also contains charts and tables for: quantities of foam solutions and time required for application for various tank sizes, and expansion and supply rates; quantities of chemicals required for foam solutions to cover various sizes of tanks with one foot of foam; relations between specific gravity, specific heat and temperature of petroleum oils; viscosity conversion chart; formulas and conversion factors for oil; specific gravity and density. A copy may be obtained by writing Byron Jackson Company, Berkeley, California.

Items About Manufacturers

Geo. C. McCormick, chief engineer of General Alloys Company of Boston, and Champaign, has been elected a vice president of that company.

H. W. Kaiser Company, 1836 Euclid Avenue, Cleveland, has been appointed representative for the Peabody Engineering Corporation of New York, in the northern Ohio district.

The Laney Company, 702 Kennedy building, Tulsa, has been appointed exclusive distributor in Oklahoma for products manufactured by Tube-Turns, Incorporated, Louisville, Kentucky.

Babcock & Wilcox Company announces that Fred Sprinkman and Sons—116 South Second Street, Milwaukee, Wisconsin, have been appointed distributors of its No. 80 refractory mortars and plastics for that district.

F. S. Franklin, Jr., has been elected vice president of Paxall Company, Incorporated, succeeding his father who died in August. E. P. Watrous, formerly sales manager of the company, has been elected secretary, succeeding Mr. Franklin, Jr.

L. S. Hamaker, advertising manager of Republic Steel Corporation, becomes manager of sales promotion effective August 1, according to an announcement by N. J. Clarke, vice president in charge of sales. Mr. Hamaker will assume his new duties immediately, making his headquarters at Youngstown.

Natural Gas Equipment, Inc., has announced the appointment of James C. McCluskey as sales manager, southern division, with headquarters at Los Angeles. McCluskey has been associated with Natural Gas Equipment, Inc., for the past eight years in the California and Mid-Continent fields. In his new capacity he will have charge of sales in Southern California, including the Kettleman Hills area.

Solvay Process Company celebrated its fiftieth anniversary in September and the fiftieth anniversary of the establishment of the alkali industry on this continent.

Rowland Howard was the founder and first president of Solvay Process Company, acquiring the American patent rights of Ernest and Alfred Solvay, perfecters of the method of manufacturing soda ash. In addition to cleansing sodas, the company eventually came to manufacture calcium chloride and liquid chlorine.

Solvay Process Company operates plants in Syracuse, Detroit, and Hutchinson, Kansas.

All of the manufacturers of welded chain who have accepted simplified practice recommendation No. 100-29 have recently expressed their intention to identify the simplified lines in their new catalog and trade lists, according to an announcement by the division of simplified practice of the National Bureau of Standards.

According to Alexander B. Galt, acting chief of the division of simplified practice, "there is every indication that manufacturers in other industries, who have cooperated in establishing simplified practice recommendations, will adopt this same policy of identification." This forward step indicates a realization by producers, distributors and consumers of the value of cooperation in applying self-government to business.

The Blaw-Knox Company announces that Nicholas Gerten, formerly vice president of Blaw-Knox International Corporation of New York City, has been elected president of that organization.

Mr. Gerten joined the Blaw-Knox organization in January, 1928, as sales manager of Blaw-Knox International Corporation. He was formerly an engineer in the technical department of Mitsubishi Company in New York and prior to that was with Allied Machinery Company, a subsidiary of American International Corporation, engaged in the export of American machinery.

Chain Belt Company, Milwaukee, from August 1 to September 21 is conducting a prize contest for missing links in practically any business. The announcement says:

"In every plant, no matter how well mechanized, there are points where material piles up, unnecessary labor used, machine operations interrupted, where better transportation is needed.

"Now is the time to hunt out these missing links.

"Chain Belt Company is offering $500 in prizes to those that hunt them out.

"For the best descriptive article and rough sketch showing how chain and belt conveying or other Chain Belt Company products, including construction machinery, can be applied to lower costs, this company offers the following prizes:

"First prize, $200; second prize, $100; third prize, $50; 15 prizes $10.

"No obligation is involved. Articles will be judged on merit—no proposed installation is too small or too large, only that it be in an existing plant.

"During 1931, Chain Belt Company found that its cost could be reduced through the application of modern machinery, by more than the reduction in cost of materials. This contest is instituted to bring out similar situations in other plants."

Contest rules will be sent on request.

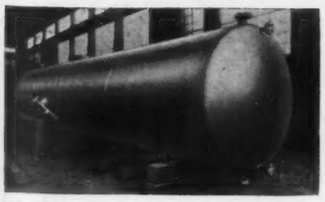
Laclede-Christy Clay Products Company, St. Louis, has acquired the assets and business of Walsh Clay Products Company of St. Louis, a subsidiary of Mississippi Glass Company, and Buckeye Clay Products Company of Toledo, Ohio, subject to ratification by the stockholders of Laclede-Christy.

Acquisition of these two plants, under one management and control, will provide greater efficiency in operations, and larger appropriations for scientific research work in refractories. The Laclede-Christy company has for a great many years held a Fellowship in the Mellon Institute, for research work in refractories for glass manufacture, and has also conducted its own laboratory with a large personnel at one of its plants in St. Louis. It is planned to increase these facilities; and the result is expected to be greatly increased service and facilities for taking care of the refractories requirements of glass manufacturers as well as other industrial concerns.

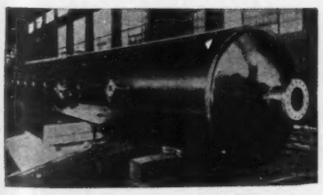
It is contemplated that the executive officials of Buckeye Clay Pot Company will be retained, as well as some of the personnel of the Walsh Company. Wm. K. Brownlee and A. S. Zopfi of Buckeye Clay Pot Company will become members of the Laclede-Christy organization, and will be in better position to serve the trade with the increased facilities.

The other officers of Laclede-Christy are: John L. Green, president; W. J. Westphalen, vice president and general manager; J. H. McKelvey, vice president in charge of sales; K. M. Baggot, secretary; L. C. Hewitt and J. L. Crawford, ceramic engineers.

.Biggs. Welded Vessels



Welded Butane Gas Receiver



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It reduces labor and material costs in operation upkeep and repairs on boilers, turbines, engines, pumps and piping.

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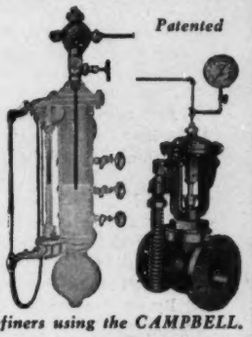

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